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ALGIERS AS A WINTER RESIDENCE.

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(With a Coloured Plate.)

VERY few people are aware of the riches and beauty of the French colony that lies only two days' journey from Marseilles. To the artist, Algiers offers quite an unrivalled field for picturesqueness of costume and gorgeousness of colour; to the tourist, a diversified and wonderful country peopled by distinct races, each having a historic and romantic interest; and to the invalid, a climate which without any extravagance, may be called perfect during six months of the year.

The journey from London to Algiers is pleasant enough, occupying four or five days. To those who are fortunate enough not to suffer from *mal de mer*, nothing can be more agreeable than to skim across the blue Mediterranean in the light *Messagerie* steamer. One generally finds a company of talkative, genial French officers on board, and from them learns something in advance, of the country which has suddenly become the most interesting of all others. It is easy to see that Algeria is not a strong point in national vanity, and that by universal opinion the colony has no brilliant future before it. The country is fertile to a fable, the climate is superb, the situation of the port could not be better; yet all these advantages are as nothing weighed against such grievances as undue taxation, Arab incendiaries, the want of good roads, and so on, *ad infinitum*. It is, therefore with some sort of preconceived sympathy that one sees the first silhouette of the Libyan coast, thinking less of Dido and her story as we scanned it in our schoolboy days than of Abd-el-Kader, marauding Arabs, and French families striving to get a scanty living in the once-famed granary of Europe.

The first view of Algiers is sufficiently striking. Built upon a hill, its sunny green terraces of Moorish houses glisten

as if of marble against the bright blue sky. To the left of the city stretches a chain of olive-clad hills, plentifully dotted with white villas; whilst beyond, so pale in outline as almost to be mistaken for clouds, lie the far-off snow-peaks of the lesser Atlas.

Hotels are not too plentiful in Algiers; and for travellers who are spirited enough to venture upon oriental housekeeping, it is advisable to take one of the pretty furnished villas in the suburbs. Once established, the traveller will find ample distraction in wandering among the narrow streets of the old city, and studying the unalloyed element of oriental life that still prevails there. We see scene after scene out of the *Arabian Nights*—here a youthful Aladdin in crimson fez and orange-coloured vest, truanting with idle companions—there a dark-cheeked Morgiana bound on some special behest—now some veiled princess, accompanied by her negresses bound to the bath—or a gloomy door is opened by some grave Moor, and you catch glimpses of an airy court, planted with bananas, and having a fountain in the midst.

In the ugly French arcades which have been built upon the site of picturesque old streets are to be found all the civilizations of modern life, such as omnibuses, shops, and cab-stands. Indeed, but for the stately Arabs passing by, and the bronze skins of the negroes shining in the sun, you might fancy yourself in some small town of the provinces.

In the country, the two elements, French and Arab, are mixed in about the same proportion. You meet group after group of handsome, tawny-skinned fellows driving in donkeys laden with wood, oranges, or poultry; or a stately, well-mounted caid, leaning back in his embroidered saddle; or a camel from the interior, ridden by a wild-looking Ishmael, wrapped in white burnouse. It would be hard to say whether the town or the country offers most interesting matter for observation; both to the student of Arab or colonist life, the field is large and varied.

Alike striking and impressive is the spectacle of Mahometan worship, whether seen as we saw it, in the lighted Mosque during the Rhamadan, or out in the fields at sunrise, where a couple of solitary worshippers raise their hands towards the east, "out of which cometh our help."

The coloured plate prefixed to this article is from a sketch by Mrs. F. Le Bridell, and represents a scene of evening prayer.

Again, there are the ceremonies of the Mahometan Sabbath, when all the women betake themselves to the cemeteries, and pray to the souls of the dead. Nothing can be more oriental and picturesque than the groups of white-robed

figures among the palmetto shrubs. And whether the ceremonial has become one of mere custom or not, one can hardly help associating some sort of solemnity with it. Then there are religious festivals among the negroes by the sea-shore, which, for weird effect and wonderful show, surpass anything we have ever seen—dances of exorcists, sacrifices of calves, and cocks to the ginns, or evil spirits, celebrations in honour of Eysona, a lesser Mahomet, and, in fine, sufficient matter for speculation to all interested in the present and future of Islamism.

No one can refrain from a feeling of sympathy with French colonist life. As one travels from one French port to another, and rests for refreshment at little oases of civilization on the way, it is easy to learn a great deal both as regards the past, present, and future of the settlers. Things are certainly not promising; rich as is the country in natural resources, admirably as it is placed with regard to the mother country, and much as the Government has affected to take its interests to heart, Algeria offers no El Dorado for the poor or enterprising of the French people. And something is to be laid to the door of the people themselves. The French do not make good colonists. They do not carry their Lares and Penates with them, with the intention of founding a Latium, having lost Troy. They come over to Algiers with the hope of making a speedy fortune, and then returning to France.

Of course this sort of view has a deteriorating influence upon the moral and material influence of the colony, and upon the colonists also. They do not build and plant for posterity, but for the day, and having little interest in the adopted country except as a sponge to suck money from, it is hardly likely that they will serve her interests save as they fall in with their own. Yet we might apply Sidney Smith's speech regarding Australia to Algeria, "But tickle the soil with a hoe, and it laughs into a harvest." Anything, everything, can be done with it. And besides the sources of cereal wealth, are an infinity of others, as yet unworked and offering quite a new field for enterprise.

We are by no means disposed to overlook counterbalancing difficulties. The incendiaries of the Arabs alone have ruined many a hard-working farmer, and we, have only to glance at the *Rapport de la Commission d'Enquête* on this subject, published in Paris last year, to be sensible of the fatal antagonism still existent between Arab and Frank, Mussulman and Roumi.

Not entering upon this intricate and interminable subject, however, we will say a few words about Algeria from a tourist's point of view, and then speak more especially of the climate.

Place yourself within a day or two's journey from Algiers, and you are as completely out of the world as the most *blasé* tourist could desire. If you are a sportsman, there is plenty of game from the plover to the panther; quails, partridges, hares, gazelles, jackals, hyenas, filling the space between the Alpha and Omega of the list. To catch sight of the panther, one must travel a hundred and fifty miles from Algiers, and there having reached the snow-tipped Atlas Mountains, may, perhaps, find a lion too, if benighted in the cedar forests.

For an artist, there is such inland scenery as few people ever associate with "Afric's burning plains," as Bishop Heber has it; delicious orange gardens, sunny plains sprinkled with wild flowers, gorges of almost Alpine grandeur, olive-groves glossy green, rivers wandering amid a flame of oleander blossoms, mountain scenery vivid and varied as only African skies can make it; and lastly, the ever-picturesque element of Eastern life. Of course, we cannot enjoy such a feast of nature without some hardships. The traveller must make up his mind to ride over very rough roads, to sleep in caravansaries or in tents as the case may be, and not always in clean beds, to eat any dish that comes in the way, without too much inquiry as to the matter or manner of it, and not to expect much intelligence from such Arab guides as he may have to deal with.

With regard to the Algerian climate, there is not a doubt that it is in some respects incomparable from October till May. The air is soft and moist, and slightly bracing. When the sun would otherwise be too hot, there are refreshing breezes blown off the sea, and the nights are invariably clear and cool. On the hills, too—we are now speaking of the suburban part of Algiers—the weather is uniformly fresh and invigorating even when the summer is advanced, and the inhabitants of the town are suffering from the heat. Never shall we forget spending last Christmas-day in a Moorish villa at Mustapha Supérieure, one of the prettiest, healthiest, and most elevated spots within an hour's walk of the city. The skies were bright and cloudless, the hill sides were clothed with foliage and flowers, and ladies were plucking roses and violets in their gardens bareheaded. It was, in fact, a June day. And with the exception of rains, the winter of Algiers is uniformly mild, though every day is not, of course, like that just recorded. At night, one is glad of a little wood fire, and especially in the airy country houses, which are admirably built for coolness and air. In fine, we should say that for diseases of the chest and lungs, the climate of Algiers offers all the advantages without the drawbacks of other and more popular resorts. The fresh sea-breeze, the elasticity of the air, the absence of any depressing atmo-

spheric influences, are certainly arguments in favour of this statement, and there are other minor considerations not to be overlooked. The charming scenery, the agreeable English society, the moderate price of hotels, and the practicability of conducting a *ménage* on one's own account, the abundance of fresh vegetables and delicate game wherewith to tempt dainty appetites—all these things are so many items necessary to an invalid's comfort.

We only hope that any words of ours may induce those to whom east winds are emissaries of destruction, and fogs poisons deadly as Socrates' draught, to escape from both, and wing their way southwards with the nightingales and swallows. It is not pleasant to all to cross the Mediterranean, and not practicable to many, to quit England for six months in the year, but those who make the effort for health's sake will not do it in vain.

And we can hardly imagine any clouds that could not be dispersed from the mental horizon by a little sojourn in so lovely a land. Southern skies, oriental associations, majestic cedar-forests, sunny plains, snow-tipped mountains, and gold-green valleys—surely such combinations as these are seldom found outside the charmed circle of Algeria?

And the best of all is that as yet these things are unknown.

[Note by the Editor.]—A very interesting collection of pictures of Algeria, by Mrs. F. Le Bridell, and Madame Bodichon, was recently on view at the German Gallery, Bond Street, where, we believe, a few of them still remain. Mrs. Bridell supplied a series of figure pieces, and Madame Bodichon illustrated the landscape scenery of the French colony. Two pieces by Mrs. Bridell, one in water-colour, and another on a larger scale, in oil, illustrated one of the most pathetic and pleasing of Mahometan superstitions, and which is alluded to in the preceding article. It is believed that the spirits of the dead visit their tombs on the Sabbath (Friday), and are able to hold commune with their relatives and friends, who resort to the cemeteries for this purpose. In one of her pictures Mrs. Bridell represents with much beauty of drawing and colouring, and with a depth of expression rarely equalled, a young girl at the tomb of a relative, and addressing a departed spirit; while in the companion piece, the same girl is in an attitude of reverential attention listening to the answers which the spirit is believed to give. The figure-drawing in these pictures is excellent, and the landscape accessories bear the impress of fidelity, and harmonize admirably with the sentiment of the subject.

Amongst the other pictures by Mrs. Bridell, an "Arab Girl at an Embroidery Frame," the "Head of an Arab Girl, her hair Dyed with Henna," "Arab Musicians Chanting a Benediction on the House of a Bride," "Sidi Ben Cassim taking Coffee," and an "Arab Woman by the Sea Shore," possess a high degree of merit, and are likewise valuable as illustrating picturesque forms of life. By a resolute perseverance in overcoming difficulties, and with the friendly aid of the Duchess of Magenta, who highly appreciated her labours, Mrs. Bridell saw Arab and negro life in Algeria to an extent permitted to very few strangers, and she succeeded in obtaining sitters in cases where most artists who have made the attempt have failed. The result is that she has returned from Algeria with materials for very striking pictures, which our readers will no doubt find opportunities of seeing. Sacred and secular associations—the Bible and the Arabian Nights—give an undying charm to good delineations of Eastern life, and in Mrs. Bridell's pictures we see that combination of the actual with the ideal which proves the artist to have felt and understood her theme. Madame Bodichon's landscapes transport the spectator to the beautiful scenery of Algeria, and amongst many of much merit, one especially, a twilight scene, with a heron amongst tall rushes, is remarkable for its harmonious colouring, and its exquisite sensation of calmness and repose. In another piece, dark, weird-looking cedars stand in a rolling sea of rising mist, with very picturesque effect; while other sketches show us "Algiers from the Sea Shore," a wild romantic scene in Kabylia, etc. The coast of Algiers, with its red rocks, bears some resemblance to parts of South Devon, but a peculiar and striking character is given to the landscape by palms, cactuses, and other plants foreign to the English eye.

MODERN JEWELLERY AND ART.

BY WILLIAM DUTHIE.

ALTHOUGH the associations which connect jewellery with art are very strong, it does not necessarily follow that the connection itself is an intimate one. These associations are in part traditional, and in part the result of the charm which the materials of jewellery in themselves, by their natural beauty, exert over the mind in an æsthetic sense. Gems, gold, and silver suggest ornament, and ornament implies art, but the union between the two things—the harmonious blending of form and material—is often sadly imperfect. Perhaps no workman, in modern times, has employed the materials placed at his hand to so little advantage, in an artistic sense, as the jeweller. What art has done within the last quarter of a century in stone and wood, and the coarser, cheaper metals, is something admirable. It has moved the architect, the sculptor, the wood-carver, the modeller and founder in brass and iron, to efforts and results which will assuredly be remembered in future days; and has helped on the nation in its great course of æsthetic progress and refinement. But nothing of this kind can be said of the jeweller, who has been content to produce lame, mongrel copies of ancient art productions; has dealt in the slang and vulgarities, as it were, of daily life, epitomized into gold, and garnished with gems to serve as pin or brooch; or who has gone to the ironmonger and the brass-founder for his newest patterns.

It is surely time that this cause of reproach should be removed. Something has already been done in the way of improvement in design in jewellery—not a word of fault-finding should be said as to execution—and it is only necessary to arouse the public themselves to the deficiencies of this branch of art, to ensure their correction. It is, in fact, the public who are chiefly to blame for the monstrosities which disfigure the jewellers' show-windows, and with which they, the public, esteem themselves to be adorned. The artizan must, as a matter of necessity, produce that which will sell, or the shopkeeper will not accept of it; and the shopkeeper's chief art is to discover the idiosyncrasies of taste of his customers, and this he does with a wonderful aptitude. The jeweller may appear in some cases to lead the public taste, but he can only do so by pleasing it; and if he make what in commercial phrase is a "hit," in the production of some grotesque article of jewellery—grotesque in its attempted originality, or vulgar in its imitation of something in ordinary use—it is the taste of

the customer which rules the market, and not that of the shopkeeper, who has simply detected the weak points of his patron's fancy.

It is not here asserted that the jewellery daily exposed for sale, or made to order, is not showy, pretty, and even handsome in one point of view; or that there are not meritorious efforts made to produce works of artistic skill, sometimes with considerable success. The better class of shopkeepers would not admit within their show-rooms the paltry, meretricious class of jewellery, upon the sale of which others again chiefly live; and it is by this better class, who claim to have a style of their own, and who do indeed collect together excellent specimens of tasteful combination and workmanship, that anything like a state of art is maintained in the manufacture of articles of personal ornament. But it is contended that there is an absence of real art, and of that knowledge of first principles upon which all true art is based, among those whose business it is, and whose assumption it is, to be the interpreters of æsthetic outseekings in the domains of personal adornment, in gems and in the precious metals. Great advances have doubtless been made in the general effect of the jewellery produced of later years, as compared with that of the times of the Georges, but this effect is attributable to other causes than artistic beauty of form, or even combinations of colour, and in too many cases the effect is a false one.

If we seek for examples of the styles of art produced at different periods since the mediæval ages, what do we find? Coarse, plump, and awkward outlines; little discrimination in the mingling of colours; and very inferior workmanship. Indeed, in our own country, since the reign of Elizabeth, there is scarcely a specimen of jewellery proper extant, which can serve as a model to us of the present day. There has been much good embossing and chasing throughout that period, and occasionally the enameller gives us glimpses of the best efforts of his art; but there are few works in which a unity and completeness of design, a refreshing contrast in the colours of the gems or enamels employed, and a harmoniousness of effect in details, which make up the perfect specimen, to win our praise or excite our emulation. There are not wanting, here and there, isolated details which are charming; as if all the materials for a perfect work were at hand, but that there failed the master-mind to select and mould them together. There are no evidences of the controlling taste of a Benvenuto Cellini, the tracings of a Holbein, or the minuteness and perfection of finish of the Brothers Müller, shown in many an example in the Grüne Gewölbe of the Zwingler at Dresden. Even on the continent, during this period, there is not very

much to boast of; and the best specimens of jewellery there, as at home, take the shape of pure diamond-work.

As was naturally to be expected, it was in the arrangement and manufacture of diamond *parure* that the best display of really artistic progress was shown. There the draughtsman and the modeller were thrown back upon their own resources; for, seeing that little was to be effected, as a rule, by contrast of colour, so much more devolved upon grace of form and boldness of relief, for ultimate effect. The diamond-workers were always a better trained, and better paid class of men, than the goldsmiths, and the costly material upon which they were employed permitted an outlay, and demanded a degree of attention, which the labours of the goldsmith could dispense with. But even the diamond-work made on the continent from the beginning of the sixteenth century, down to within the last fifty years, was heavy, inartistic, and, considering its value, ineffective. Perhaps the Venetian diamond-work was the best, and much of this excellence resulted from the manner in which the gems were cut, viz., rectangular, with deep, single facets, and a broad flat table. Venice then led the way in most of the arts, and it is not surprising that her diamond jewellery should excel that of all other countries. In England, till within the last half century, diamond ornaments, in common with all kinds of jewellery, were simply execrable. Perfectly flat, and although usually imitative of some kind of foliage, with no more relief or modelling (*movement*, the French call it), than a platter, the jewel was rather a rude mass of silver, in which diamonds were here and there set, than a piece of work with any traceable design. It was usually a cast block with a rounded back to each stone, and no gold whatever upon it beyond what was necessary as a means of fastening it to the dress. Where the pattern was not clearly floral, it was a mere jumble of grotesque shapes, not traceable to any original on the earth, or in the heavens.

The first real improvement in the design of diamond-work originated in Vienna, and from its very character led to new and more artistic development. It began in a *parure* of slender grass leaves, from which were pendent small stars, or dew-drops, and its best feature was a conscientious desire to follow closely upon nature. For a long time the simple field flowers and long grasses were the ruling models of diamond-work in the Austrian capital. The new fashion soon spread from Vienna to Paris, and thence, through French and German workmen, to London. At this time what is technically called "thread setting" was little used in London. The English workman prided himself upon his "grain setting," *i.e.*, his work, whether leaf, flower, or nondescript orna-

ment, was pared away on the edges, leaving long round-topped grains between, and on the side facets of the stones. All ornaments alike were subjected to this treatment, which gave a rounded appearance to the work, and destroyed all outline. This style of setting is described as "cut down," from the manner in which it is effected, and the Englishman was proud of his "cutting down." "Thread setting," on the contrary, preserves a fine *filet*, or line of silver on the outer edge of the portion of the leaf or flower, the sharp outline of which it is desired to preserve, and by a judicious use of the two methods, an admirable degree of relief is given to the whole ornament.

The advance of the Viennese in their search for art in the footsteps of nature led to most important results. The simple grass leaves were succeeded by foliage of a more ornate character; flowers of most complex construction were made the prominent features in the tiara, the brooch, or the stomacher, till no object was considered too difficult of imitation in the plastic silver, to be afterwards encrusted with diamonds so thickly as to leave little but a shell or skin of the original material to bind them together. It may truly be said that jewellery, in its employment of the diamond chiefly, attained perfection in these floral ornaments. The taste of the draughtsman and the modeller, and the skill of the workman, were combined to produce them, and the result was the creation of works of true art. Many of the best specimens of this class of workmanship were made in London, but, it must also be said, by foreign artizans, chiefly French and German. The style of the present day is no longer the same, but the skill and the taste remain, although scarcely employed so advantageously. The fashion of the moment runs in favour of a species of Arabesque or Byzantine interlaced work, to which it would be very difficult to give a name, but which is effective in so far that it allows of the massing of stones on a rounded surface, broken up by narrow interstices, and a few gems are made to produce the dazzling effect of many. Diamond-work finds a further development in simple five-pointed stars, placed at intervals on an interlaced band.

There is little to be said for the goldsmith's handicraft from the time of Elizabeth to within the last half century. The old skill and artistic aptitude of the workman, derived from Italy, and developed under the Tudors, did not immediately die out in England, but it was not likely to gain an accession of strength in the more prosaic and unsettled times of James and of the Charleses. There was doubtless plenty of work to be done for both jeweller and goldsmith in the latter part of the reign of Charles II., but it was more showy than

artistic, and has not lived. What did live, however, and give repeated signs of healthy vitality, was the art of chasing and embossing—in its result more often called repoussé-work—and many fine specimens of the art, executed at this and at a later period, are to be found. But repoussé-work is scarcely applicable to jewellery proper, and was chiefly employed on tazzas and other silver plate, but oftener still on the gold cases of watches, and the principal portions of chatelaines.

The eighteenth century was the age of snuff-boxes, etui-cases, bonbonnières, scent-bottle mounts, and a host of similar productions, in which great cleverness and some taste was displayed; and of paste waist-clasps, and shoe-buckles. What is more to our purpose, however, is the fact that at this period several kinds of finger rings of great taste, and very careful workmanship, were made. One kind is called the "Giardinetti" ring, and consisted of a sprig of leaves and flowers, formed of diamonds and garnets, the latter set to imitate rubies, but among which other stones are very often introduced. These rings are in endless variety, and often have an ease and grace which make them deservedly prized. There were also what are commonly called Queen Ann's rings, made of a single stone, an amethyst, a topaz, or a table diamond, in a close cramp setting, with a peculiarly light scroll shank, and an exquisitely fluted gold back. The double scroll on the shoulder of the ring was sometimes of silver, and held in its folds a small square cut gem, usually a ruby or a diamond. Then there were the crystal memorial rings, in which a single crystal, with a narrow facetted edge, was set over a gum-plait of hair, in the centre of which was a minute cipher made of twisted gold wire. The crystal was cut with a broad culasse, which rested directly upon the cipher, and allowed it to be seen clearly through. It must be especially noted that the pride of the setter at this period was that his work, whether of real gems or paste imitations, should be "sound," that is, capable of excluding air and water; which is much more than can be said of the setting of the present day. Some of the paste ornaments, in imitation of diamond work, of this time, although utterly devoid of beauty of design, were wonderful specimens of clean, close workmanship, and often retain their lustre untarnished after the lapse of a hundred years.

At the latter half of the eighteenth century, engine-turning was much employed to ornament large surfaces, and was made available as the ground-work for the enameller whereon to place his translucent glasses. The enamelled work of this period is very good, more especially the dead white and the purple, and a kind of dark puce (*pieuse?*) which has since been called mauve. Engine-turning was brought to great

excellence, but has now fallen into comparative disuse, together with another kind of machine tooling, at one time in great request for rings and ornamental edgings, called *nerling*. This *nerling* was the pressing of a pattern engraved on a small steel wheel, by means of a lathe, on to any metal wire or edge prepared to receive it. Then we come upon what may be called the garnet period, a distinct era in the history of jewellery, and which was of long duration. So far as design went, nothing could be more bald and tasteless than the single rows of round or oval garnets, or the occasional jumbling together of several stones in a cluster to give variety to the pattern. By this time the jeweller's art, as implying a knowledge of drawing, and the moulding of his materials into relief, was at its lowest ebb; but his garnets were of the finest claret colour, were carefully cut, and set and foiled to perfection. The diamond-jeweller still maintained his supremacy, and although his designs were flat and meagre in spirit, he managed to display considerable cleverness in small works, as in rings—*la bague marchise*, for example—and in ciphers; but here again the effect was in a great measure marred by the use of the cramp, or "cut down" setting, instead of the "thread," which did not permit of the modelling, so to speak, of the letters. The garnet period only gave way to the period of filagree work, and the substitution for the garnet of the pink and yellow topaz, the jacinth, the chrysolite, the chrysoprase, the use of the zircon, or jargoon, instead of rose diamonds; the introduction of stone-cameos, set, in imitation of Roman work, in bright red gold, with yellow nerled edges; and last, though not least, the amethyst.

The filagree work which now came into fashion was simply a revival, under modifications; for this use of twisted and screwed wire dates from the oldest times. But it was a vigorous revival, and held its ground for some years. When at length it yielded it was to the superior attractions of a spurious Elizabethan, and an equally spurious Renaissance, scroll work. That taste dying out, there was awakened a passion, puffed into flame by a wind from Germany, for turquoise *pavé*, in balls, half balls, oval and round excrescences, perched upon and dropped into all kinds of uncomfortable places where they had no business to be. Conjointly with the turquoise *pavé*, came the fashion for large plain wire work—a sort of golden maccaroni, involved and knotted, but to what end no mortal could tell. Sometimes this wire work took the shape of simple round or oval rings, inexplicably interlaced, like a conjuror's puzzle; at other times it resembled most a huddling of earth-worms. The turquoise *pavé* and the plain wire work have still their admirers; and the latter was but the precursor

of a series of monstrosities. Among them came the horse-shoes, the straps and buckles, the jockey caps and whips, the screw-heads, the folded copies of *Bell's Life*, the padlocks, door-plates, bolts and bars, and cups and balls, which have long been the fashion. The jeweller's art in short fell among the pots, pans, and kettles of every day life, and, to a great extent, it is among them still. There has been, it is true, in the mean time, a Roman revival, here and there decidedly successful; and an Anglo-Saxon revival, which has somehow made rock crystal its principal medium of interpretation, and which has some very good features joined to its natural plumpness and heaviness; and a partial mediæval revival of a monkish character, which speaks in monograms and alphabetical puzzles. A great deal of good may be said for all these revivifications, unfaithful copies as they are of their quaint originals, but for the sporting, and what may be called the poker and shovel jewellery, there is only one word—it is simply despicable.

But cannot something really original be designed in our personal ornaments? Or, if we must be copyists, can we not choose good models, and copy faithfully and conscientiously? Is there no leaf or flower that may serve to give us new ideas of form or combinations of colours? It would appear as if the baser the material, the more was the artist drawn to rescue it from oblivion by his genius; and the more precious the matter to be dealt with, the less care was needed to embellish it. Our schools of design produce draughtsmen who furnish admirable patterns to be woven in wool and cotton; models to be executed in wood and stone, in iron and brass; elaborate compositions to be worked out in glass, and common potter's clay; and is there no cunning hand to devise forms of symmetry and beauty for the employment of gems, of gold, and of silver? What the sculptor has done, what the wood-carver has done, what the weaver and spinner have done, for their art, cannot the jeweller do for his? There are exceptions to every rule, of course, but we do not want the exceptions to monopolize the place of the rule; and that is practically the case with regard to the taste in composition of the most part of modern jewellery. A new pattern is simply a matter arising hap-hazard from something already in existence; it is scarcely ever an original conception; and the most commonplace objects are generally chosen as the base of the design, or as fit models, *pure et simple*, for illustration.

The fact is, the modern jeweller has allowed himself to be dazzled by the very materials among which he labours. With him all *is* gold that glitters. When the precious metals were scarce, and gems were rare, a Cellini could be found

who would build up a fairy fabric of graceful proportions and magic colours, to embalm jewels which were more prized for their names than for their beauty; or a Holbein to trace symmetrical outlines, and mingle brilliant colours in softening harmony, for the jeweller's behoof. But now that gold abounds, and gems were never so abundant or so beautiful, the artistic element is neglected, or allowed to fall through altogether; and the jeweller entrenches himself behind his dazzling store, and flashes their unassisted rays in the eyes of his customers. There is more skill, more talent, more appreciation of the beautiful even, among workmen now than at any time within the last century, if it were only turned to proper account. A true piece of jewellery should be as much a work of art as a picture, or a figure sculptured in marble; and there is no possible reason why it should not be so. There is no want of lovers of ornament, or of wealth to devote to its study; it is only necessary to place the fact clearly before one, viz., that the most beautiful materials for ornament in creation are only half utilized for their best purpose, or are degraded into meretricious imitations of commonplace objects. It is not so with the silversmith. All that refined art and delicate manipulative skill can perform is lavished upon our race-cups, our épergnes, our centre-pieces, our candelabras, to the delight of all beholders, and the permanent advancement of art itself. The material is comparatively valueless; it is the spirit breathed into it, the wonderful skill of execution which gives the vase, or the group of figures, its value. Whereas, in the case of a piece of jewellery, it is usually the cost of the gems, not the beauty of the design nor the delicacy of the workmanship, which is the subject of admiration.

The fault of this comparative lack of art conception in jewellery rests greatly with the public. So long as the taste of the public lies in horse-shoes, and straps and buckles, the jeweller is not likely to strive to anything much higher. The public should be the real teachers, not the slavish pupils of the manufacturer; and if gentlemen would devote the same study, and the same natural taste, to their family jewels—not necessarily in a spirit of costly outlay—as they do to the building of their mansions, the furnishing of their halls and studies, or the laying out of their grounds, the jeweller would be found an apt and willing scholar. A piece of jewellery would then become a real work of art, as it was in days long gone by; a series of models for cheaper ornaments being created, the general taste would be improved; and eventually the abortions and apish vagaries of modern jewellery would disappear, to the great comfort of all true lovers of art.

CHACORNAC'S SOLAR THEORIES.*

In addition to the series of lithographed "*bulletins*" from the observatory of Ville-Urbanne, M. Chacornac has just issued what appears to be the first part of an important essay, in which he arranges the facts which he has observed, so as to exhibit the theories he has formed.

He states, that an examination of the sun with a good telescope, even of small dimensions, enables the observer to see that the shining surface is not smooth, like that of a substance in liquid fusion; but that it is made up of luminous elements, matted together like meshes in a network composed of a viscous material, and not analogous to anything existing on the earth; although to a certain extent the appearances may be compared with threads of metal or melted glass, in a sufficiently viscous condition to solder them close together, to change their shape, and to enable them to disperse or assemble, like snow-crystals, under the influence of atmospheric currents. Conceiving the analogy between these solar phenomena and those of crystallization to be very strong, M. Chacornac speaks of "photospheric crystals," and defines the photosphere by saying that "it is composed of innumerable photospheric crystals united together." The shape of these crystals is not, as was supposed, uniform; and, though more often threadlike, they will be found to exhibit all the imaginable figures that a paste in a state of violent fermentation might be expected to offer.†

According to the definition given, the solar photosphere is not continuous, and behind (au travers des) the photospheric crystals a dark background is seen, on which all the strata of the envelope project themselves (un fond obscur sur lequel se projettent toutes les formes des strates de cette enveloppe).

Observation also shows that the vast agglomerations of photospheric crystals move independently of the fundamental stratum, as if the upper portions floated in an atmosphere, as clouds do in the air.

In the month of April, 1850, M. Chacornac states that he discovered that the spots or cavities in the photosphere were only formed by the dispersion of the photospheric crystals, and by a partial swallowing up or engulphing of the photo-

* "Notice sur la Constitution Physique du Soleil." Par M. Chacornac.

† Many observers will not agree with M. Chacornac in considering that the photospheric bodies bear an analogy to *crystals*, and there is little resemblance between forms produced in paste by violent fermentation and those which result from crystallization.

sphere. At that time he observed, and has since been confirmed in the opinion, that at certain points the photosphere seems to melt, and become like ice on the surface of a lake, which, under the influence of a considerable weight, slides obliquely into the liquid. In this way enormous photospheric fragments are engulphed while preserving their form, but losing their brightness as they sink. On the 3rd of December, 1858, he observed a luminous avalanche, larger than our earth, engulphed in this manner. During the interval between these meltings (effondrements) of the photosphere, he has observed a contrary action, like a condensation of the exterior atmosphere into luminous masses. This appearance he considers analogous to the formation of the "crystalline clouds," which we name *cirrus*.

As a provisional conclusion, M. Chacornac regards the sun as "a liquid incandescent mass, surrounded by a thick atmosphere, imperfectly transparent; and whose ultimate limits extend to great distances beyond the central body." This atmosphere he considers to extend not less than two or three times the length of the solar radius, and to its attracting power is due the difference in tint and splendour of the centre and margin of the disk. This immense atmosphere increases in density in its lower layers, which are near the surface of the liquid ignited mass. "After a series of photometric measures of the light of the penumbra, compared with the most considerable extinction of light which the photosphere experiences when it plunges by narrow isthmuses into the depth of the cavities, we come, with the help of depression measured in the *penumbra*, to the conclusion that the central body is situated at a depth about ten times greater than this depression." The lower layers of the solar atmosphere must acquire an immense temperature through contact with the incandescent mass, and the great pressure they experience; and from variations in their temperature perpetual movements arise. The liquid surface of the sun must vary in temperature from a variety of causes, such as ascending and descending currents, and variations in the diathermancy, or heat-transmitting power, of different portions of the atmosphere. A rapid and constant evaporation goes on from the liquid surface supplying the matter, which is precipitated in a crystalline form.

"When we examine the sidereal universe with reference to the probabilities which determine the incandescence of stars, we are convinced that the principal cause is the condensation of agglomerated masses of cosmical matter." M. Chacornac points out that, with a given pressure and temperature, vapours will have a density little below that of a liquid; and it is, therefore, reasonable to suppose that, at a certain distance

from the limit of the mass of solar vapours, they condense themselves into fluids at high temperatures, in which the laws of cohesion approach those of bodies in fusion. In admitting that temperature and pressure increase with depth, we may conceive that the central solar mass finally acquires the perfect condition of a body in fusion.

When solar vapours at high temperatures leave the surface, they rapidly ascend to a region in which radiation is energetic, and in the exterior regions of the solar atmosphere they are acted upon by the cold of celestial space. Under these circumstances condensation and crystallization occur, accompanied with the emission of light.

M. Chacornac calls particular attention to the fact, that in the phenomena of spots the gas that seems to escape from the central body dissolves the engulphed portions of the photosphere, just as crystals dissolve in a liquid; but "in certain cases, when the gaseous central emanations cease to disperse the photospheric matter, and to enlarge the openings in it, it may be seen that engulphed fragments of photospheric matter are augmented in volume, with loss of their incandescence, as if the luminous crystals had become transformed into nebulous vapour, reflecting only the light of the photosphere."

The gases of the absorbent atmosphere above the incandescent zone, or those which form aureoles during an eclipse, are not very luminous, as they reflect a large portion of polarized light. The incandescent zone limiting the photosphere presents an accumulation of incandescent matters in ignition, and terminating in flames like those proceeding from terrestrial substances burning in air.

During the eclipse of July 18, 1860, the first objects which M. Chacornac observed beyond the lunar disk were jets of vapour, like those represented by Mr. Poulet Scroope, but with this difference, that instead of exhibiting ascending masses of a globular form, they run like bands with luminous streaks, like *bouquets d'artificice*, and which spread out in their upper portions as if they had arrived rapidly in a lighter atmosphere. "These vaporous jets corresponded specially with groups of acute cones of incandescent matter, which constituted the purple zone surrounding the photosphere."

M. Chacornac regards the bodies he terms photospheric crystals as continually forming at certain elevations, and being recondensed into liquids, falling back on the sun as they descend below certain limits of pressure. He also considers that the central liquid mass of the sun, in addition to the emission of vapours, absorbs gases just as melted metals absorb oxygen or oxide of carbon, and that a sudden crystalliza-

tion of the incandescent matter is accompanied by explosive emissions of gas.*

To account for the appearance of spots, exceptionally, in the equatorial regions, M. Chacornac remarks that evaporation is most rapid when the atmosphere in which it takes place is least dense, and that the quicker it takes place the greater the local loss of heat. At the sun's equator, gravity being less than at any part of his surface, the pressure of his atmosphere is less than at the poles, and thus phenomena like our trade-winds must arise. Evaporation would be very rapid at the equator, and the rarefaction of the atmosphere would favour radiation. "If the liquid, incandescent surface cools itself more rapidly at the equator than in other zones, it must give rise to currents, as the difference of temperature in our seas between surface and depths occasions superficial and deep currents in opposite directions. If the cooled layers have a tendency to descend into the interior mass, the adjacent layers make a descending rush to fill up the void. This then is a superficial current, tending to carry matter from the poles to the equator. We mark also that this current transports fluid masses animated with a movement of rotation less rapid than that of the zones which they enter, and in virtue of this retardation, they seem to lag behind when compared with the fluid masses moving in zones of less latitude."

The currents resembling our trade-winds acting in a direction opposite to the accelerated movement of the external mass—for at the equator vapours rise more rapidly than at the poles—it results, from the combination of these opposite currents, that the central mass appears to have a movement of rotation more rapid than that of his photosphere. This difference of movement occasions the particular arrangement of spots, and the formation of groups elongated in a direction often parallel.

Referring to the "magnificent work of Mr. Carington," showing, amongst other things, that the velocity of rotation of solar spots is a function of latitude, M. Chacornac remarks that it will be interesting to ascertain if a variation in the phenomenon of evaporation occasions deviations from this law.

In 1857, M. Chacornac states that he remarked a coincidence between the period of a revolution of Jupiter and two consecutive returns to a minimum of solar spots, as noticed by M. Schwabe, of Dessau, and he conceived a connection between the minima of the *radii vectories* of Jupiter and those of the

* M. Chacornac makes frequent reference to the theories of "surfusion and dissociation," by which M. Fournet and others have explained certain appearances in terrestrial geology, but we have not thought it necessary to cite these passages in detail.

solar spots. He considers the action of Jupiter in this matter to be established; and as we are now in the epoch of minimum spots, he asks whether we can recognize any influence analogous to that which M. Alexis Perrey, of Dijon, attributes to the moon over the volcanic eruptions of our planet. He thinks it probable, considering the immense mass of Jupiter, that he may cause an accumulation of solar atmosphere at the equator, augment its density and absorbing power, and thus lessen the rapid cooling actions which ordinarily take place in that zone. He likewise suggests that planetary attraction may collect some of the cosmical matter of the zodiacal light in the plane of the sun's equator, and thus mitigate both radiation and evaporation. M. Chacornac considers that the line of research followed by Messrs. Warren De la Rue, Balfour Stewart, and Loewy, is calculated to settle these questions.

In a note M. Chacornac says that since the text of his paper was written, other observations make him believe "that a central body may be clothed with an incandescent ocean, and that penumbra are craters of elevation." Our present object is not to criticise, but simply to give an account of the most generally interesting portions of M. Chacornac's important publication.

PHOTOGRAPHY AS A FINE ART.

Those who considered that the function of the artist was merely to copy natural objects with accuracy and fidelity, were (though erroneously) prepared to be satisfied with the operations of photography as soon as they were conducted with a sufficient amount of technical skill. There are certain cases in which art realizes all the conditions of deceptive imitation, and it is not very difficult to paint a butterfly, or a deal shaving so that a spectator might actually expect to be able to catch the pretended insect, or pick up the thin curly slice of wood.

When this mechanical fidelity is realized, there are many persons who conceive that nothing more is to be desired, and they form in their own minds a rude and inaccurate mode of estimating pictures according to the amount of realism which they exhibit.

A little more acquaintance with the facts of nature and the possibilities of art soon lead to the conclusion that realistic imitation is only possible to a very limited extent, and that in the main what may be called the imitative part of the artist's work consists in transposing, according to natural laws, the

facts of nature into the technical language of art. The painter can make no real imitation of the light which streams from the sun or the artificial fire, and his scale of light, shade, and colour is not only much lower, but in many respects different from that of nature. Only to a slight extent and under favourable circumstances can he, with any success, make the slightest attempt to imitate the strength of white light as seen in nature, and the art of the colourist is shown in his power of *transposing* what nature has composed in keys of actual light into corresponding, but not resembling, keys, such as his pigments enable him to provide.

The eye, as a living organism, does not remain in one and the same condition during any considerable portion of time in which an object is contemplated. Thus, if an object consists of parts in different planes, rapid focussing changes will occur in the eye, and the impression of vision is not the simple result of any one of these focussings, but a sort of average resulting from all. The perception of colour is not a simple affair. According to original sensitiveness and cultivation, the sensation of a colour is followed by another sensation of its complementary hue, and when two or more colours are simultaneously presented to the eye, very slight differences in the direction of that organ, and in the attention which the mind pays to its indications determine the precise result that is produced. The brightness of natural objects seen in full lights not being imitable by the artist, it follows that his productions cannot have the same power of summoning up complementary tints. Again, natural objects are more or less in motion, and more or less affected by motions of light and shade upon them, and the artist has to select and stereotype one out of many successive appearances presented to his view.

A few considerations of this kind will show how soon the limits of realistic imitation are reached, and it must also be remembered that even if accurate imitation were possible, it would not satisfy the human mind, which demands imagination, sentiment, emotion, as well as beauty in works of art. But it is generally supposed that photography comes to us with something like a perfection of imitative capacity. This is not the case. Instead of photography being necessarily right, imitatively considered, it is necessarily wrong. In the first place its focussing is a compromise, and if we take one of the best specimens of photographic landscape, its treatment of foreground, middle distance, background and greater distance, will never be found conformable either to nature, or to the impressions which, through the eye, the scene depicted makes upon the mind. In nature yellow light is the next in point of brightness to white light. Photographic machinery turns it into black.

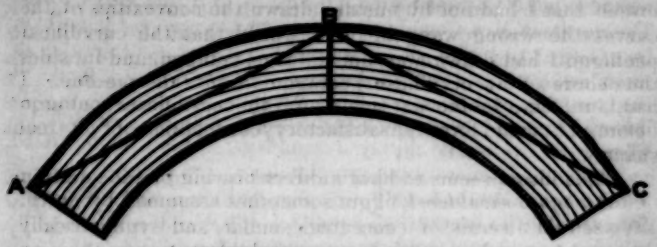
The natural scale of brightness as connected with colour is constantly at war with the photographic scale; and the results of this conflict are seen in all photographic works which attempt to give a black and white version of a polychromatic object or scene.

The rise amongst us of the pre-Raphaelite school, and the modifications which that school, as represented by its leading artists, has undergone, has familiarized most minds with questions pertaining to detail or generalization. To paint a number of leaves and branches correctly, according to imitative notions, is not to paint a tree as any mortal ever saw it or could see it, when he looked at it as a whole. Too much detail for the conditions of a picture damage its verisimilitude as well as its art. Too vague a generalization is still more fatal, because it is wanting in particular truth. A drawing of a particular man so generalized as to be as much like any other man of the same race and clothing, would be an absurdity if it could be produced, and the true artist has to consider how far he is to generalize, and how far he must particularize in order to produce the best result—one of truth combined with beauty and with suggestive power.

If a number of good and bad photographs are examined, it will soon be found that, in addition to their merits or demerits, as attempts at imitation, they will vary in approaching to or receding from the kind of delineation which great artists delight to give. The artist imitates the appearance of nature in which delicately graduated lights and shades indicate the forms of objects seen in and surrounded by an atmosphere. Photography has a constant tendency to the child's blunder of making hard firm outlines where nature avoids them. The best of the orthodox school of photographers mitigate this mischief, but we are not aware that any one besides Mrs. Cameron has fairly attacked and vanquished it, and thus established a connecting link far stronger than any which previously existed between photography and fine arts. Mrs. Cameron has been engaged for several years in this labour, and her productions have been for some time before the public; but some of her most recent works have been the most remarkable, and have called forth from artists of the highest eminence a very enthusiastic, and, as we think, richly deserved praise. Mrs. Cameron has especially devoted her talents to two objects, both usually neglected in photography. The first is the realization of a method of focussing by which the delineations of the camera are made to correspond with the method of drawing employed by the great Italian artists. The second has been the introduction of an ideal pictorial element, by selecting good models and calling forth the kind of expression

which a judicious artist would desire to enshrine in his work. The results of Mrs. Cameron's labours may be seen at Colnaghi's, in a large collection of photographs, varying considerably in merit and interest, but all bearing testimony to originality of purpose and artistic skill. Here we have the head of a boy, full of fire and expression, simple and grand as a sketch by Correggio, which it closely resembles. There is no dead mechanism of mere photography here, but emphatically a work of art, instinct with life and motion. The hair flows freely, as if the breeze had caught it, the outlines are soft and melting, the play of light on the blooming features marvellous to behold. In another piece the same boy figures as *Love in Idleness*, a handsome mischievous urchin playing with his bow. An exceedingly well-managed group represents *May Day;* two other portraits are combined into an artistic and effective *Prospero and Miranda*. Other subjects of Mrs. Cameron's skill give us *Esther and Ahasuerus, Friar Laurence and Juliet;* while single figures, remarkably like drawings by great artists, are named, *The Mountain Nymph, Sweet Liberty, Adriana, Sappho, Clio, Christabel*, etc., etc.

In some of these cases we do not find ourselves able to follow the suggestions given by Mrs. Cameron in naming her pieces, the Greek ones especially seem to us, as a rule, to have much more of the character of mediæval Italy; but no one, free from professional photographic prejudice, can see them without being struck with the high degree of artistic merit which they possess, and the contemplation of works so original and so beautiful, leads to the conviction that photography need not remain in the lower stages of a mere imitative craft. Mrs. Cameron not only claims for it, but wins for it, the dignified position of a fine art, and we are glad to notice that copies of her works are offered for sale at very moderate prices. It is good for artists as well as amateurs that there should be this sort of competition. Ladies, like Mrs. Cameron, who break through the conventional nonsense which attempts to scorn industry the moment it seeks for profit, are doing good service in their day and generation. It is probably not of the slightest consequence to her whether she gains or loses by photographic pursuits, but, as her works are substantially good, and capable of multiplication, she is morally right in letting the public have the benefit of them, and economically right in accepting whatever legitimate profit they may produce.



DECEPTIVE FIGURES;

WITH REMARKS ON SATURN'S "SQUARE-SHOULDERED" PHASE.

BY R. A. PROCTOR, B.A., F.R.A.S.

In the April number of the INTELLECTUAL OBSERVER, p. 224, instances have been given of an optical illusion affecting our estimate of the relative *size* of figures placed in particular positions with respect to each other. In the figure accompanying this article a somewhat similar illusion affecting *shape* is illustrated; the lines A B and B C, which appear to have a decided curvature, being in reality straight lines.

In figures constructed on a larger scale, and with concentric circles closer together (in proportion), the deception is still greater; and it is remarkable that the illusion is increased by drawing equidistant lines radiating from the centre of the concentric circles. I notice, also, that a want of symmetry in the drawing seems to destroy the illusion.

The deception struck me as remarkably perfect in the case in which I first observed it. I had drawn the meridians and parallels for a polar star-map on the equidistant projection, to the scale of an 18-inch globe—the parallels to every degree, and the meridians, from the 20th parallel of N. P. D. to the bounding parallel (N. P. D. 37° 23′) of the map, also to every degree. Thus the map formed a circle 11¾ inches in radius, with 37 concentric circles crossed by 360 radiating lines, drawn with as much uniformity as possible. Now before marking in stars, I wished, as a matter of curiosity, to determine the exact figure on the *equidistant* projection of the spherical pentagon, which in my *gnomonic* maps appears as a true pentagon. I accordingly drew in, in pencil, first the inscribed pentagon, and then (through points determined by their known R. A.'s and N. P. D.'s) the five curved sides of the figure I required. Thus the sides of the true pentagon formed chords of the five sides of a curvilinear pentagon

outside the true one. But now I could scarcely persuade myself that I had not by mistake drawn the convexities of the curves the wrong way; in other words, that the curvilinear pentagon I had drawn was not a true pentagon, and its sides the chords of a curvilinear pentagon *inside* the true one. I had, in fact, to take a tracing of the curvilinear pentagon before I could form a satisfactory conception of its real shape.

This illusion seems to have a direct bearing on the question of the *square-shouldered* figure sometimes assumed by Saturn. We see that a series of concentric, similar, and symmetrically disposed curved lines, give to a straight line crossing them an appearance of curvature in a direction opposite to that of the curved lines. Hence a line drawn with a certain slight curvature in the same direction as the curvature of the concentric lines would appear straight, and a line with a greater curvature would appear to have its curvature diminished. Further, if such a line were continued beyond the concentric lines, the alteration of curvature would disappear at a short distance from the concentric lines. Hence H's observation of the flattening of Saturn's equator, and his determination of a maximum diameter and curvature at latitude 43° (not far from the apparent intersection of the ring's outer boundary with the outline of the disc) seems to be satisfactorily explained. Yet it cannot be denied that there are grave objections to the optical explanation of the phenomenon. One would expect that the illusion would be perceptible in pictures of Saturn; that it would be always observable, or, if it be supposed to depend on the extent to which the rings are open; that it would always be noticed when the rings are open to a particular extent; that it would disappear when the rings are closed; that it would not affect micrometrical measurement—or, if it affected such measurement in one case, that it would do so in all cases. A perusal of Mr. Webb's review of the evidence (pp. 250–252 of the May number of the INTELLECTUAL OBSERVER) will suffice to show that not one of these conditions is fulfilled.

I venture with great diffidence to offer some considerations which seem to point to a different solution of the difficulty.

If we assumed, either that the atmospheres bear any proportion to the masses of planets, or that any provision is made by increased depth of atmosphere for diminution of solar heat, we might fairly suppose that the height of Saturn's atmosphere is nine or ten times as great as that of our own atmosphere. Now the earth's atmosphere has been supposed to extend to a height of from 100 to 150 miles (Nichol's *Cyclopædia of the Physical Sciences*, Art. "Atmosphere"); but taking the more moderate estimate of 50 miles, the height of Saturn's atmo-

sphere might be assumed to be from 450 to 500 miles.* Our positive evidence is not, perhaps, very strong. The circumstance that the constitution of an atmosphere so far removed admits of determination by spectrum-analysis seems to indicate that the height of the atmosphere must be considerable. Mr. Grover's observation of a penumbra surrounding the planet's shadow on the ring (*Astronomical Register* for August, 1865, p. 212), "always noticed" even with the moderate telescopic power applied by this observer, also points to the existence of a strongly refractive atmosphere. Herschel's observation of a remarkable retardation of the occultations of Mimas and Enceladus has not been confirmed; but, perhaps, this is hardly to be wondered at. There are not ten telescopes in the world capable of following these two satellites up to the moment of their disappearance, and since the date of Herschel's observation there have only been five intervals, each of a few weeks only, during which the observation has been possible. It is true that where the further part of the ring appears to meet the disc at an acute angle, its outline should be distorted if the planet have a refractive atmosphere; but it is easy to see that the distortion would scarcely be appreciable even with the most powerful instruments, and Mr. Grover's observation above recorded is sufficient to show, that details observable with very moderate powers may for a long time escape observation. It will presently be seen that I am not here losing sight of the evidence pointing to a reflective power possessed at times and in certain latitudes by Saturn's atmosphere.

Now it has been observed by Professor Challis,† that the atmospheres of planets must have certain definite limits, since "the density continually decreasing with the height, a point must at length be reached at which the upward repulsive force of an atmospheric stratum is just equal to the force of gravity; in which case there can be no downward repulsive force, and therefore no further extension of the atmosphere." And he considers, that the effect of an atmosphere on our estimate of a planet's diameter will depend on "the relation between the gradation of density of the atmospheric strata and the curvature of the globe." This relation may be such that a ray would "pass *through* the atmosphere in a course which grazes, or is a tangent to, the interior globe;" or else, that rays could not reach "the surface of the globe in a direction making with it an angle less than" a certain limiting angle. In the first case

* Schröter estimated the height of the atmosphere of Ceres at 668 miles (!); a result which can hardly be considered as established.

† In an article on the "Indications, by Phenomena, of Atmospheres to the Sun, Moon, and Planets," *Notices of the Astronomical Society*, vol. xxiii., pp. 230–238.

the apparent diameter would "most probably not be sensibly increased;" in the second, "the increase would be the angle which the whole height of the atmosphere subtends at the earth." Now it is clearly possible that the atmosphere of a planet might in general exhibit one of these relations, but for a season might present the other, either over the whole planet or in certain latitudes only; and we have distinct evidence that Saturn's atmosphere is of variable refractive power, for whereas in nearly all pictures of Saturn, and notably in Mr. De la Rue's admirable engravings, the disc is darker at the edges than at the centre, so that this may be supposed to be the general appearance of the planet, the contrary appearance was presented in one instance to Bond II., and in another to Chacornac. Now it is perfectly clear, that if for a season the atmosphere over certain latitudes assumed the second state described by Professor Challis, while the remaining part was in the former—which we may perhaps be justified in calling the *normal* state—an apparent irregularity of figure would result. The outline of the disk would correspond in the former latitude to the upper limits of the atmosphere, in the latter to the limit of the interior globe; and we may suppose that in the intermediate latitudes the outline would pass from one limit to the other by indefinite gradations. There are reasons also for supposing that the "reflective state" would be more commonly assumed in Saturn's temperate zones than near his equator or poles. For the causes to which our trade-winds are due are exaggerated in the case of Saturn. Now Sir J. Herschel thus describes the circulation of our atmosphere:—"In each hemisphere inferior currents of air run in on both sides towards the equator, and superior ones set outwards, all around the globe, from the equator towards the poles. It is quite clear that neither near the poles nor near the equator, from or towards which these opposite currents tend, is it likely that there will be that tendency to stratification of the atmosphere into layers of variable density which favours the "reflective state." On the other hand, this state may be expected to occur—not commonly, indeed, but occasionally—in the temperate zones, where these currents attain their greatest velocity and steadiness of motion.

It need scarcely be remarked, that an apparent difference of level of 500 or 600 miles in latitude 40° or 45°, would be fully sufficient to account for Saturn's "square-shouldered" figure; but there are reasons for supposing that the height of Saturn's atmosphere in these latitudes exceeds the mean height. For it is found that barometric pressure attains its greatest value in the temperate zones; and although this phenomenon has never been fully accounted for, it appears highly

probable that it is due to the rotation and figure of the earth; and therefore it seems probable that, in a planet of the figure, dimensions, and rapid axial rotation of Saturn, the excess of atmospheric pressure in the temperate zones would be still more marked.

It would be interesting to examine whether the square-shouldered figure seems to be connected with the occurrence of changes in the configuration of the Saturnian belts, or whether it is only assumed when the belts have remained for a long time in the same, or nearly the same position.

ASCENT OF CADER IDRIS.

BY D. MACKINTOSH, F.G.S.

(*With a Coloured Plate*).

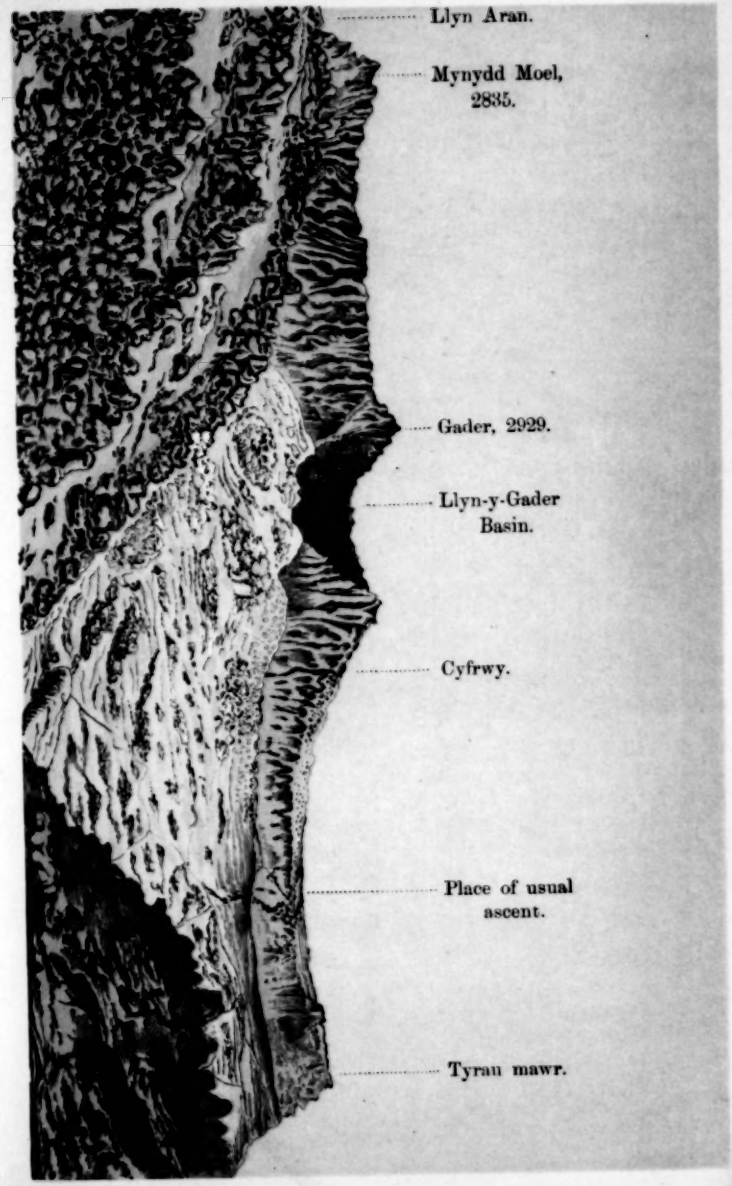
It is to be regretted that guide-book writers, in describing Cader Idris, should copy and perpetuate the errors of one another, so as to leave the tourist in ignorance of what he may really expect on making the ascent of this mountain. To supply, in some measure, this defect, I made a brief survey of the topography and surface-geology of Cader Idris in May last; and it is but doing justice to the mountain to state that my expectations were far more than realized. If the attractiveness of a mountain is to be estimated by the number of abrupt and striking inequalities compressed within a small compass, Cader Idris is perhaps equal to any elevation in Britain; and in the extent of its rocky cliffs and precipices it is certainly superior to Snowdon. It may be described as a long table-land, narrowing towards its eastern termination, and irregularly sloping towards the south. On each side of this table-land there is a range of rocky cliffs, which must strike the most ignorant observer as very similar to what may be seen on many sea-coasts. On the south-eastern, or Tal-y-llyn side, the cliffs are very picturesque, and often grotesquely shaped; but, as this side is not likely to be very much visited in future,* and as one side is sufficient for a whole article, I shall at present confine attention to its northern front, and the neighbourhood of the peak.

The northern or Dolgelley side of Cader Idris is a continuous escarpment, extending like a rampart for a distance of at least eight miles; the principal and most rocky part of this escarpment is about four miles in length. It commences on

* I was informed at Dolgelley that, owing to the completion of the Welsh Coast Railway as far as Penmaen Pool, the Machynlleth coach will in future be discontinued.

the west with a bold and striking headland called Tyrau Mawr. For some distance, in an easterly direction, it consists of a steep grass-covered slope, with frequent rocky projections. On the surface of a large flat stone on the side of this slope I noticed a distinct series of ice-grooves, only a little roughened by the weather during the time that has elapsed since they were imprinted. Further on, the escarpment graduates into a line of bare rocky cliffs, with debris or "screes" strewn along their bases. These cliffs are deeply indented with vertical rents and passages, which often ramify backwards so as to leave detached pillars. On approaching Llyn-y-Gader the cliffs become more massive, and rise to an almost appalling height. Here their bases are buried in screes, which run down into the transparent waters of the llyn. On the east, a continuous wall of rock extends to the headland which frowns over the town of Dolgelley; this headland terminates abruptly in a *cwm*, or inland cove, on the southern side of which it sends off a spur in the direction of the Arran range of mountains.

The principal screes are to be seen in the neighbourhood, and to the west of Llyn-y-Gader. They are partly derived from the breaking down of the cliffs, and here and there a large block has evidently very recently fallen; but a distinction must be made between debris, strictly so called, and the immense accumulations of stones to be found both at the base and on the summit of the mountain. The ridge-like buttresses, consisting of loose fragments, which, in many places, may be seen underlying large fissures in the cliffs, are chiefly the result of cataracts of stones which have tumbled down, not from the cliffs themselves, but from the heaps of loose fragments on the summit. These heaps, in many places several yards in depth, have been scattered, piled on each other, and apparently forced up the acclivity of the saddle-shaped eminence called Cyfrwy. They are generally columnar and pentagonal in shape, and are frequently made use of as gate-posts, lintels, etc. The number of stones on this part of Cader Idris would probably be sufficient to build a good-sized town. They are to be found in smaller quantities on other parts of the mountain. How these stones came there cannot be easily explained, even in the present advanced state of geological theory. The agency of land-ice is not applicable to a high and narrow table-land where no ice-shed could have existed. The action of the sea, assisted by ice-floes and coast-ice, at the time when the summit of Cader Idris was slowly sinking beneath or rising above the sea-level, would appear to offer the most probable explanation; and to this agency we may likewise attribute the stupendous accumulation of stones found lying beneath the mountain, in positions where they could not have fallen from the neigh-



GADER IDRIS.

From a hill on the north of the Old Towyn road.

bouring cliffs. A scramble over the latter to the lake (Llyn-y-Gader) of which they form the western barrier, is about as severe an exercise for a pedestrian as can well be imagined; though the only real danger to be apprehended is a sprained ankle.

The small, round, and deep lake-basins form the most remakable feature of the scenery of Cader Idris. The two best known are Llyn-y-Gader and Llyn Cae. The first may be found on the north side of the mountain, immediately under the Gader peak. It embraces about half a circle, and is bounded by high cliffs. The lake is dammed in by a ridge of stones, beneath which, in all probability, there is a solid rocky barrier, so as to give this hollow the character of a true rock basin. The water has no visible egress, though there can be little doubt that it percolates through the outer part of the stony barrier. It is not surprising that early travellers should have looked upon this basin as a volcanic crater formed by explosion, and that the neighbouring accumulations of stones, already mentioned, were the effects of the explosion. It is, however, to be regretted that the most modern guide-book writers should borrow their geology from the days of Pennant, and speak of pumice-stone, and other subaërial volcanic products, as being found on Cader Idris. In a certain extensively-circulated guide-book not only is this error perpetuated, but Llyn Gwernan, two miles from Dolgelley on the old Towyn road, is called Llyn-y-Gader, and the latter is left without a name; while Wilson is represented as having painted Llyn-y-Gader, whereas it is well known that Llyn Cae was the subject of his celebrated picture. It is a pity that guide-book writers should not take the trouble to visit the spots they attempt to describe. No geologist would now regard Llyn-y-Gader as a volcanic crater. It has evidently been scooped out of the alternating slaty and submarine volcanic rocks of which the mountain consists; but the cause of the excavation admits of difference of opinion. This basin, as well as Llyn Cae, may certainly have been deepened by ice, but its situation would appear to preclude the idea of a glacier having formed the whole of the crateriform hollow. The undermining action of a tidal current, at the time or times when the rocky rampart of Cader Idris was a sea-cliff, would appear to be the explanation most in accordance with our knowledge of the effects of recent geological causes. During the glacial submergence the excavation may have been completed, if not principally effected, and the sea may have been powerfully assisted by the action of coast-ice.

On proceeding along the usual route, and before you arrive at the base of the Gader peak, you suddenly behold the

black profile of the inner cliff of Llyn Cae, forming the gable end of a grass-covered ridge. The top of the cliff is almost perpendicular (that is, overhanging, in the phraseology of guide-book writers, but really at an angle of about 85°), and as you see the basin gradually deepen underneath, and the cliff assuming the shape of a peak, an impression never to be effaced is left on the mind. The rocky edge of this peak is so extremely sharp as to suggest the idea that it has buffeted the tempest and the waterspout since the sea last undermined its base.

> There it remains, dark emblem of decay,
> Revealing silently the wondrous way
> In which the icy tide's tumultuous flow
> Wore out the awful gulf that yawns below!

On making the ascent of Cader Idris, it is usual to proceed for about two miles along the old road from Dolgelley to Towyn. This road at first rises gradually to the level of an irregular terrace, which extends along the base of a high rocky outlier of Cader. You pass Llyn Gwernan, and soon leave the main road. You then take one of the zig-zag paths which act as torrent-channels in winter and pony-tracks in summer. You reach the summit of the Cyfrwy, or Saddle, with little difficulty, and then proceed in an easterly direction, skirting, and sometimes encountering, the accumulation of columnar stones already described, until you arrive at the base of the peak. This peak is a mass of solid rock, with projections, pillars, and intervening loose fragments. It is precipitous on *all* sides, and in this respect is superior to the summit of Snowdon. The tourist may here amuse himself in trying to make out the part of the mountain which mythologists have dignified as the chair of Idris. Do they suppose the giant to have reposed in the basin of Llyn-y-Gader, with his feet dangling down into Llyn-Gafr, and his head leaning back against the Gader peak? Or do they place him sitting in the more secure caldron of Llyn Cae, the inner cliff of which resembles the back of some of our old wooden arm-chairs? Or, contented with regarding him as approaching the size of an ordinary mortal, do they suppose a likeness between a chair and a certain rocky hollow near the summit of the peak? The latter would seem to be the true solution of the problem.

You have no sooner commenced the ascent of the peak than you begin to be struck and overawed with what at first seems an illusion, but is not long in being realized, namely, a gulf on each side of unseen profundity. You find yourself on a narrow ridge of fantastically-shaped rocks, between two precipices which slant down into apparently

bottomless pits. You can throw a stone with either hand over both precipices without stirring from the spot. The breadth of this isthmus (for an isthmus between two rolling seas at one time it must have been), from brink to brink of the two lake basins, is certainly not more than two hundred yards. By deviating a little to the right or left, and grasping a rocky projection, to give a sense of security and prevent a giddiness few can resist, you are enabled to see the water—on one side pellucid, on the other (Llyn Cae) dark and dismal—at an appalling depth below.* On reaching the apex, and leaning against the pillar of stones erected by the Ordnance surveyors, any previous sense of terror becomes replaced by delight on seeing Snowdon rearing its counterpart peak on the distant horizon, the hills on the opposite side of Cardigan Bay, the Breiddon Hills in Shropshire, the Black Mountains of South Wales, and (if the day be unusually fine) the distant coast of Ireland. After this the task of descending does not appear so hazardous. You take a last look at Llyn Cae, in its gloomy horror never to be forgotten; you proceed on your way rejoicing that you have made the ascent of the most remarkable, if not the highest mountain in Wales, and you soon find yourself among the habitations of mankind. Courageous and hardy pedestrians ascend and descend Cader Idris by a steep track almost immediately under the peak, and to the east of Llyn-y-Gader, and this is the only route mentioned in Black's *Picturesque Guide;* but it may be well to warn the majority of tourists against attempting this route, which, leaving danger out of the question, will be found to be more fatiguing than the one usually chosen.†

* The level of the waters of Llyn Cae must be at least a thousand feet below the apex of the peak.

† On the 28th of last month (May), the body of Mr. James Smith, of Newport, Monmouthshire, was found at the base of the precipice on the Llyn-y-Gader side of the peak. His skull was fractured, neck dislocated, and one foot detached from the body. At the inquest held at Dolgelley it was agreed that he must have fallen from the summit. He had been missing since the 20th September last.

NOTES ON FUNGI.—No. VI.

BY THE REV. M. J. BERKELEY, M.A., F.L.S.

BLACKISH PURPLE, OR BROWN-SPORED MUSHROOMS, TOGETHER WITH THE BLACK-SPORED SPECIES.

The first division, *Pratelli*, consisting of six subgenera, *Psalliota*, *Pilosuce*, *Stropharia*, *Hypholoma*, *Psilocybe*, and *Psathyra*, contains our more important esculent Agarics. Many of the species are small and unimportant, while some in the first subgenus are amongst the largest and most noble Agarics. The spores in the more typical species are of a dark blackish purple, but in others they are of a dark or ferruginous brown. In some instances from imperfect development, they never acquire their proper colour, while in others the gills are absolutely barren, and in consequence assume a very abnormal appearance, a circumstance which occurs also amongst the dung Agarics or *Coprini*.

Psalliota (from ψάλιον, a collar) is distinguished by the hymenium being absolutely distinct from the stem, the gills being rounded behind and free, and also by the presence of a ring. All the species grow upon ground more or less richly manured, and in some the spores seem to require to pass through the stomach of some graminivorous animal, to facilitate their germination, a circumstance which accounts for the occurrence of the common mushroom wherever horse manure is present.

It is difficult in this subgenus to say what is a species, what a variety, but some forms at least seem to stand out more especially above the rest.

Perhaps the most beautiful of British Agarics is one which occurred in Flintshire two years since, and which, from growing in the district of Elwy, was named *A. elvensis*. The pileus, which is six inches across, is fibrillose, and broken up into large persistent brown scales, the disk areolate, and the margin covered with pyramidal warts, and from its pleasant taste and smell is undoubtedly esculent. *A. cretaceus*, of whose esculent qualities little is known, is remarkable for the stem being deeply sunk into the flesh of the pileus, as in *Agaricus procerus*, and for the very pale gills and spores, in consequence of which, some doubt has occasionally been entertained as to its real affinities; and it has been sought for either in *Lepiota* or *Pluteus*. It occurs occasionally in hothouses and about cultivated grounds, but generally in very small quantities, and is often solitary.

A. arvensis, the horse mushroom, or incorrectly, St. George's mushroom, is a large coarse species, in general occurring in rings, but sometimes in scattered groups, and is known at once from the true mushroom by its tendency to become yellow, and sometimes intensely yellow, when bruised, and its paler and at length more dingy gills. In its more normal state it is of a pure white, hemispherical and very fleshy, with a ring which looks as if it were made up of two, one within the other. Small conical varieties, however, occur, and others which are scaly and of a tawny yellow tint, as in *A. augustus*. To this, perhaps, the variety called *A. villaticus* in the *Outlines of British Fungology*, is referable, rather than to *A. campestris*.* Most of the varieties are wholesome, and while in Italy *A. campestris* is rejected, this has obtained the name of *A. exquisitus*, while in France it is well known under the name of *Boule de Neige*. Great prejudice exists in many parts of the kingdom against this species, which is rejected by most professed cooks and housekeepers on account of its turning yellow; but in some parts of England it is highly esteemed, while in London it forms far the greater part of the mushrooms which appear in the market. It is, however, almost universally used for ketchup, for which purpose it is far superior to many of the doubtful if not dangerous species which enter into that frequently questionable condiment. There is a variety mentioned by Mrs. Hussey, as the hedge mushroom, which grows in tufts under hedges, and though innocuous in ketchup, produces, when eaten, violent sickness. This never has the least tinge of yellow, and the pileus is regularly covered with small brown scales. Another form —much like it—mentioned by Mrs. Hussey, which grows on the borders of woods, and which turns of a yellow red when bruised, is, on the contrary, very highly valued. This, however, was considered by Dr. Badham, a form of *A. campestris*, and I am inclined to subscribe to his opinion. It was probably on this variety that a village schoolmaster, in Northamptonshire, who found it for many weeks in succession in an open plantation, nearly kept his family, without their experiencing the slightest inconvenience. I am not able to speak positively as to the species, as I never saw an individual, but his description and the locality pointed in this direction.

Of the merits of *A. campestris*, it is not necessary to say much, as every one, in this country at least, is pretty well satis-

* Dr. Badham writes respecting it:—"Do you meet with this scaly form of *A. exquisitus* in Northamptonshire? it is the first time I have seen it here, and but for the yellow tinge exuding from it when cut, and the grey gills, I should have supposed it a scaly specimen of *A. campestris*, which is often coated with similar brown scales." Brondeau's *A. villaticus* is vinous when bruised, in which character alone it differs from that of Dr. Badham.

fied on the subject. Variable as it is in colour, form, size, and sculpture, the peculiar pink gills, and the tendency to be pink when bruised if any change takes place, are in general distinctive characteristics. Many varieties of this occur both in the field and under cultivation, and it is a mistake to suppose that the brown pilose form is the only one that occurs in artificial beds. Several varieties were figured some years since in the *Gardeners' Chronicle*, and one at least, from its prolific nature, would have been an acquisition could it have been kept distinct.* The artificial formation of mushroom spawn was once considered a great mystery, and a powerful argument in favour of spontaneous generation, but the key to the mystery has been given above. At Belvoir Castle, where there is a great riding-school, the comminuted straw, which is collected from the pavement, when heaped up and occasionally turned, is used with complete success for the growth of mushrooms, without any artificial spawn. The stove mushroom, which is cultivated in enormous quantities in the catacombs at Paris, is almost the only one which is admitted into the Paris markets. A mode of cultivating the mushroom from the spores, by making them vegetate on glass under the influence of saltpetre, and then removing the young brood into artificial beds, was, a few years since, much talked of at Paris, and raised great expectations from the quickness of growth and the size of the supposed produce. The whole, however, came to nothing.

Mushrooms are subject to disease like other plants when cultivated. Not only do they become deformed without any apparent reason, but they are sometimes attacked by a minute fungus belonging to the genus *Hypomyces*, which obliterates the gills altogether, and entirely alters the texture. It would not be safe to consume such individuals, even in an early stage of growth without great caution, supposing their aroma not to be affected. It is scarcely necessary to add that such maladies are quite beyond control. In one instance, instead of mushrooms, a crop of shapeless dark bodies appeared, one of which, when coaxed into its complete development, proved to be an undescribed fungus of the genus *Xylaria*. A figure of this has lately been published in the *Transactions of the Linnæan Society*.

It is not easy to conceive why such a prejudice against *A. campestris* should exist in Italy. If the supposed cases of poisoning are really due to the species, and not to something mixed with it, which has sometimes happened in this country, we can only imagine that a larger quantity of amanitine is

* Some spawn which was prepared at Belvoir and sent to me by Mr. Ingram, produced exclusively a long stalked, pure white, nearly smooth variety of excellent quality.

formed in it than with us. There is not, however, the slightest evidence to show that this is the case, and we must wait for better information. *A. campestris* occurs in all parts of the world, and Mr. Drummond reported that a variety occurs in Australia which as far exceeds any European form in quality as our improved peas surpass those which were formerly in cultivation. He sent over samples of the spawn, but though great pains were taken by Mr. Henderson, the late talented gardener of Earl Fitzwilliam, it would not run. In addition to the distinctive characters given above of *A. arvensis* and *A. campestris*, a more subtle one, but one not liable to deceive a practised mushroom-gatherer, exists in the peculiar smell of the former, which is also possessed by the very abundant and deeply penetrating mycelium. I have seen in recently ploughed-up pastures, where rings of *A. arvensis* were abundant, large tracts of mould perfectly white with the spawn, and at once proclaiming what it was at some distance by its odour.

The quantity of mushrooms collected every year for ketchup is enormous. The ketchup is seldom made by the gatherers, who are not very particular what they put in their baskets so long as it yields a brown liquor; and as the contents are at once salted bad kinds cannot in general be detected by the mushroom merchant, if he is inclined to be scrupulous. They command from a penny to fourpence a pound, or very seldom a trifle more. The merchant does not always prepare the ketchup directly, but sometimes keeps the salted fungi in barrels for months. Good ketchup may be prepared from morels, *A. procerus*, *A. gambosus*, *A. prunulus*, *Marasmius oreades*, and some others, but all do not yield an equal quantity of juice. Mrs. Hussey recommends a way of preparing it without boiling—the clear juice, free from all sediment, being placed in small bottles and filled up to the shoulder, the remainder being filled with proof spirits, in which the requisite spices have been steeped. She adds, "all who try this plan fairly will acknowledge they never tasted ketchup before." Ketchup made from the Marasmius is exceedingly strong, and like garlic requires to be used with caution.

It would not be right to leave this subject without mentioning *A. silvaticus*, which is not uncommon in woods, and which, though in some respects agreeing with *A. campestris*, has not the same pleasant odour, and is distinguished easily by the stem being stuffed with delicate threads. It is a species which should certainly be used with caution if not altogether rejected.

It remains only to notice a single species belonging to the subgenus, on account of its singularity, but certainly without any respect for its intrinsic value. *A. echinatus*, remarkable

for its dingy pileus, covered with smoke-coloured meal, and its blood-red gills which often yield only effete spores, occurs now and then upon peat in gardens. In all the species there is a universal veil, though not always distinct from the partial veil. In *A. echinatus* this is represented by the copious meal.

It is not necessary to dwell on the subgenus *Pilosace* (from πῖλος, a hat, and σάκος, a shield), which is distinguished from *Psalliota* by the absence of a ring, as we have no British representative.

The subgenus *Stropharia* (from στρόφιον, a girdle) was formerly included in *Psalliota*, but has been very properly separated on account of its gills not being decidedly free as in *Lepiota*, *Volvaria*, *Pluteus*, and *Psalliota*. It does not seem to contain a single esculent species, though one has the reputation of being extremely poisonous. *A. æruginosus* is sometimes a beautiful object when fresh from its verdigris-green pileus, clothed with white floccose scales. Both the green tint and scales, however, vanish with the first shower, and the beauty is gone. It has a peculiar smell like that of cerate, and is in all probability poisonous. *A. albo-cyaneus*, of which a figure (No. 3) is given in our second coloured plate of Fungi, published in the Intellectual Observer, October, 1865, p. 184, occurs occasionally in meadows, and is distinguished by its more elegant form, and livid rather than green tint when young, in addition to other characters.

A. semiglobatus is one of the most common species, occurring everywhere on horse dung. Whether this or some other species was the cause of several deaths at Battersea when Sowerby was publishing the latter portion of his Fungi is not very clear, though he gave it, by way of indicating its supposed evil qualities, the name of *A. virosus*. It is, however, a species which could only be eaten by mistake, though it is very probable that it often gets with other dangerous species into the mushroom basket. Though in some cases the deleterious qualities of fungi may be diminished by evaporation and the free use of the salt in ketchup, there are cases on record where it has been fatal.

It will not be necessary to dwell long on the remaining subgenera.

Hypholoma (from ὑφή, a web, and λῶμα, a veil) is distinguished by the veil being woven into a fugacious web, which often adheres in fragments to the margin of the pileus. It does not form a ring upon the stem as in *Psalliota*. The species are mostly of a tolerable size, and are densely tufted. Either the taste of the primary species is bitter, or the texture tough, or the two bad qualities are combined so as to make them ineligible for food. *A. velutinus* is more tender, and is

sometimes an ingredient in ketchup. A large basket was once sent to me as a present, on the supposition that it was wholesome, but it is scarcely necessary to say that it was at once rejected.

A. sublateritius is often a great ornament in woods about the trunks of trees from its brilliant colours, but it is not always easily distinguished from similar species, and especially from the bitter *A. fasciculares*, which in its turn may be confounded with other kinds if attention is not paid to the spores. *A. capnoides* is at once distinguished by its mild smell and taste, but it is of too suspicious affinity to induce a trial of its esculent character, did it occur in sufficient abundance. *A. appendiculatus* (No. 4 in our second coloured plate),* which is a very abundant species, is readily distinguished by the abundant white fragments of the veil.

Psilocybe (from ψιλὸς, naked, and κύβη, a head), as the name implies, is destitute of a veil, except in one or two species, which grow on dung, while its incurved margin distinguishes it from *Psathyra* (ψαθυρὸς, brittle), in which the margin is straight. In either subgenus the species are, for the most part, insignificant, and often difficult to distinguish from the fugitive character of their colouring. We have given a figure of *A. bullaceus* (No. 5) in our second coloured plate,* more because it is interesting than from its being a very typical species.

The concluding division, *Coprinarii*, containing the species with black spores, consists of two subgenera only, *Panæolus* and *Psathyrella*. The former, *Panæolus* (from παναιολος, variegated), is distinguished by its rather fleshy pileus, which is never striate, and the margin extending beyond the gills, which are mottled. The species grow chiefly on dung, *A. separatus* being often very conspicuous from its shining, smooth, semi-ovate pileus and straight stem. *A. fimiputris* is often an extremely pretty object, from the edge of the pileus being adorned with little appendages which look like eyelet holes. None of the species are esculent, though they often enter into the composition of ketchup in consequence of their dark spores.

The remaining subgenus *Psathyrella* (a diminutive of *Psathyra*) has a membranaceous pileus, and the margin does not reach beyond the gills. The most abundant species is *A. disseminatus*, which springs up wherever wood is buried or on the wood itself in myriads, fading away almost as unexpectedly as it makes its appearance. This sometimes grows on plaster walls, and then springs from a dense mycelium.

The genus Agaricus comprises now at least 400 British

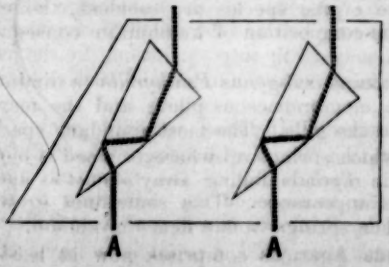
* October, 1865, p. 184.

species, to which undoubtedly many additions will be made. The present season has afforded several novelties. The study is undoubtedly involved in much difficulty, but this will be greatly diminished by a careful study of some typical species in each subgenus, for the determination of which good figures are absolutely necessary. Without some such previous discipline, it will be almost impossible to ascertain a species satisfactorily; and it is to facilitate this that the present series of notices has been prepared.

THE COMING METEOR SHOWER.—THE SPECTRA OF METEORS.

Great interest attaches to the composition of meteors, and though chemical analysis of the ordinary kind can lend its aid to the examination of meteoric stones, which fall in considerable masses upon the earth, it cannot avail with regard to the much more numerous class of shooting stars and bolides, which blaze for a moment in our atmosphere, and then disappear entirely, or leave for a few seconds the transitory traces of a luminous smoke. To learn something of the composition of these bodies, Mr. Alexander Herschel proposed the employment of a binocular direct vision spectroscope, fitted up with peculiar prisms designed by himself. This plan, which presents considerable difficulties of optical construction, has been very ably carried out by Mr. Browning; and the British Association Committee have ordered four of the instruments with a view to their employment in the coming November showers, when a maximum number of meteors may be expected.

The nature of Mr. Herschel's plan will be obvious from the following diagram. The thick dotted lines represent the path



THE HERSCHEL-BROWNING METEOR SPECTROSCOPE.

of the light rays through the prism. When a pencil of light enters the prism, it is *refracted*, and then continues its course until it meets one side of the prism, which it strikes at such an angle that it cannot get out. It is therefore *reflected* to another side, also at an angle which prevents its egress; and accordingly it undergoes a second reflection, after which it is permitted to emerge in a position opposite, and parallel to, its line of entry.

In employing an ordinary spectroscope, it is necessary to limit the admission of light by a *slit*. But if the source of light took the shape of a fine line, no slit would be required, because the mass of light would not exceed the quantity with which the spectroscope could advantageously deal. With shooting stars and ordinary meteors this is the case, and hence the Meteor Spectroscope requires no slit. Observers furnished with the new instrument will direct it like an opera-glass to the part of the sky most favourable for the observation of the November shower, and as a shooting star makes a line of light in the sky, it will give one or more lines of light in the spectroscope. If, for example, we had a sodium meteor, it would give a yellow line in the sky, and a yellow line, occupying the sodium line place, in the spectroscope. If silver were present together with sodium, the meteor train would have a greenish tinge, and *three* lines would appear in the spectroscope—yellow, green, and blue.

Those who intend to take part in these highly curious inquiries should provide themselves in time with Meteor Spectroscopes, and should, with the help of an ordinary spectroscope, study in advance the spectra of the metals and other substances most likely to be seen when the meteors are in the field.

The study of meteors is already highly indebted to Mr. Alexander Herschel, whose labours are recognized as of the highest value by every physicist of eminence; and we have no doubt that his "Meteor Spectroscope" will contribute efficiently to the progress of our knowledge of shooting stars. To Mr. Browning belongs the credit of carrying Mr. Herschel's plans most successfully into operation, by the construction of prisms with an accuracy of angle and surface extremely difficult to obtain.

Mr. Alexander Herschel recently gave a lecture at the Royal Institution, "On the Shooting Stars of the year 1865—66, and on the Probability of the Cosmical Theory of their Origin." He commenced by adverting to the probability established by Professor Newton, of Yale College, U.S., "that in the current year, 1866, a prodigious flight of meteors, the most imposing of its kind, and visible over a large area of the

earth's surface, will make its appearance—perhaps for the last time in the present century—either on the morning of the 13th, or on the 14th November."

The meteors should be especially looked for between midnight and sunrise, and may be expected in greatest abundance between three and four A.M. "They proceed, with few exceptions, from a common centre in some part of the Constellation Leo." Mr. Herschel observes that "between the 13th of October and the 12th of November, during the years from A.D. 903 to 1833, not less than thirteen great star showers have been recorded. They are separated from each other by the third part of a century, or by some multiple of this period, and are periodical reappearances of one grand meteoric shower, viz., that seen by Humboldt in 1799, and by Olmsted in 1833, the star shower expected to return in the present year, and known by the name of the "great November shower." Its contact with the earth takes place one day in the year at each of its principal returns. According to the exact calculations of Professor Newton, "the next passage of the earth through the centre of the meteoric group will take place two hours after sunrise at Greenwich on the morning of the 14th of November, 1866." A watch on the morning of the 13th is recommended, "as the moment of greatest brightness may fall one day before the predicted time." On the 13th of November, 1865, first-class meteors were seen at Greenwich at the rate of 250 per hour, and the "maximum display of the November meteors expected in 1866 is several hundred times greater than that observed at Greenwich on the 13th of November, 1865. Two hundred and forty thousand meteors are computed by Arago to have been visible above the horizon of Boston on the morning of the 13th of November, 1833."

The average height of shooting stars at the middle of their apparent paths is not quite sixty miles above the earth.

Mr. Herschel points out a singular difference in the behaviour of shooting stars and aerolites, or meteoric stones. The meteoric stones most frequently fall after mid-day, between noon and nine P.M., while the shooting stars are most abundant after midnight; and only one stone has been known to fall on the 10th of August or the 13th of November, when shooting stars are most numerous.

A point of importance to be ascertained by means of the "Meteor Spectroscope" is, whether shooting stars and their luminous trains are composed of porous matter, or of solid matter, perhaps in a finely divided state, as is presumed.

The anticipated splendour of the November shower should not be permitted to divert attention from the smaller shower expected on the night of August 10.

DR. CURTIS'S PROCESS OF PHOTO-MICROGRAPHY.

BY R. L. MADDOX, M.D.

THE beautiful specimens of photo-micrography, tracings of which we were enabled, by the kindness of Dr. Maddox, to lay before our readers in our July number, have excited so much interest, that we are sure the following letter from Dr. M. explaining the process will be highly appreciated:—

"Through the kindness of Dr. J. J. Woodward, who has charge of the Medical and Microscopical Department in the Army Medical Museum, U.S., I am enabled to offer for the pages of your valuable journal a brief description of the plan adopted in taking the photo-micrographs alluded to, and published in your July number, and which becomes of more interest, as Dr. Woodward shows by a further number of prints of various objects, taken both by sun and artificial light, the excellency of the method.

"The difference in sharpness given to the $\frac{1}{50}$th over the $\frac{1}{8}$th, and achromatic concave amplifier, is attributed by him to the chemical process employed in rendering the albumen negative intense. The smaller prints were from the original negatives, and in the enlargement from these the solar camera was not employed.

"The diatom *Pleurosigma angulatum* was simply a dry mounted specimen, adhering to the cover of an ordinary slide, which was removed, turned, and then covered by the thin glass necessary for the $\frac{1}{50}$th. The part alluded to as possibly a sun spot, was only due to a particle of adherent dust.

"The following plan is adopted by Dr. Curtis at the laboratory of the Museum—the lenses of the objectives in use being corrected for the violet ray, and the formula furnished by Mr. Lewis Rutherford, so well known for his astronomical photography; but in the $\frac{1}{50}$th, the difference between the visual and actinic foci is so small as not to be noticed in the correction:—

"Outside the window is placed a Silbermann's Heliostat, which reflects the rays from a plane mirror, duly centred, through a brass tube, at the orifice of which hangs a large cell, with parallel sides of plate glass, filled with a saturated solution of the ammonio sulphate of copper, the other arrangements of the apparatus being properly disposed in a dark room, instead of using a camera: thus practically violet monochromatic light is employed. The sensitized albumenized plates being, in this case, placed about three feet from the object for the $\frac{1}{50}$th, rather less for the $\frac{1}{8}$th and amplifier, and seven minutes' exposure allowed. The condenser used was a pair of plano-convex lenses of about one inch combined focal length,

a large central stop being placed over the flat surface of the one nearest the object, thus illuminating it with only the oblique pencils. These lenses were not achromatic, as monochromatic light was employed. The value of these details will, I trust, prove a sufficient apology for again trespassing on your space!"

ANIMAL LIFE IN SOUTH AFRICA.

BY H. CHICHESTER, ESQ.

ALTHOUGH narratives of travel and of sporting adventure in Africa have of late become so numerous, the amount of information to be acquired through their medium respecting the peculiarities of the animal world in these regions, still beyond doubt the finest game countries of the older continent, is (with one or two exceptions) scanty indeed. We propose in the following pages to notice a few among the many points thus generally overlooked.

Commencing with the hugest specimen of nature's handiwork, the elephant, we have generally found two curious points overlooked or ignored by writers—one is the rapid and noiseless movements of this animal in the thickest cover; the other, his capabilities of passing over ground for him apparently utterly unfeasible. The elastic noiseless footfall of the elephant has been frequently referred to by writers on Indian subjects, and has been rightly asserted to be the most agreeable feature in journeying on elephant-back. This peculiarity may be easily explained by an examination of the structure of the animal's foot; but the silent stealthy way in which he will pass through the densest thicket, literally "*slipping away*," when his acute senses of smell or hearing warn him of danger, has been generally overlooked, and appears to us somewhat difficult of explanation. Let any one unskilled in the mysteries of "bush ranging," attempt to move even a few paces in an ordinary fox-covert without noise, and he will form some idea of the difficulties presented to the passage of so huge an animal as the elephant through the dense tangled undergrowth of a South African "bush." Yet that the animal, despite his enormous bulk, will "draw off," when within a few yards of his pursuer, without the slightest noise, and with the greatest rapidity, even in the thickest cover, is undeniable. We may, however, remark that this faculty or by whatever other term it may be described, is not peculiar to the elephant alone, for it has been observed to a marked extent in the moose or cariboo of North America.

Again, his powers of passing over difficult ground are often underrated even by hunters. When experiments were first made* in India in training elephants to draw the guns, it was observed with surprise that the animal's powers of ascending steep and rugged ground were far greater than had been anticipated. The gun, a light six-pounder, with which the trial was first made, was drawn up a slope so steep as to require the animal to crawl upon its four knees, without hesitation. On the other hand, hampered by the gun and harness, the elephant (a small female) showed unusual dread of soft and swampy ground. In Africa, marshes do not seem to possess the same terror for these animals in their wild state, for if they offer tempting pools, however uncertain the footing may be, the elephants appear to find a track across them.† In the river courses too, deepened as they are by the torrents of the rainy season many yards below the surface of the surrounding country, and having banks nearly perpendicular, small shady pools close sheltered from the sun's rays, often remain in the hot season when the rest of the stream has disappeared, and to these, should no other way be open, may be found tracts of the animals, leaving no doubt they have reached the coveted water by slipping down on their posteriors. In what position the hinder legs are placed during this operation we cannot tell, but the "spoor" leaves no doubt of its having been repeatedly adopted in places apparently inaccessible.

The elephants generally remain in the thickest part of the forest during day, making for the water, to which they often go long distances, shortly before midnight, and returning to cover some hours before dawn. We may here remark, that although these animals, owing no doubt to their acute sense of hearing and of scent, have never been surprised in a recumbent position, there is ample proof that the bulls at any rate, usually rest lying on their sides. The late Mr. Gordon Cumming was, we believe, the first to note this fact, which we can ourselves confirm. He remarked that the sides of the enormous ant heaps so common in this region, were apparently preferred, and that the ground was often distinctly marked with the impression of the under tusk as well as of the animal's body.

The influence of the particular tract of country in which they are found upon these animals, and the influence which

* About thirty years ago by a committee of Indian Artillery officers. Elephants, we may remark, had been previously used in assisting the gun teams by pushing with their heads, and aiding with their trunks, and not by drawing in harness.

† Elephants, like the generality of wild animals, take the water readily and swim well. Even baboons, though unwilling to do so, will on emergencies, swim with strength and rapidity, although with a queer and somewhat ludicrous action.

they, in their turn, like all other living creatures, exercise on their habitat, should not escape a short notice.

On the borders of the Cape Colony and Natal, we find the few elephants that remain large in size, but with comparatively small tusks of inferior ivory. As we approach the equator, although food is far more plentiful, we find the animals smaller in size, having far larger tusks, the latter too being of an ivory far superior in hardness and closeness of grain. Indeed, although naturalists have not recognized more than one species of the African elephant, the varieties of ivory exported from the north, west, south-west, south-east coast, and the Cape, have each marked differences of quality by which they are easily recognizable. The animals in their turn, however, likewise affect the economy of the country they inhabit. The damage done even by a single elephant in a very short time to a patch of cultivated ground is truly frightful, and having been once seen, would lead one to imagine that when these animals are herded together in vast troops such as the one seen by Dr. Livingstone on the banks of the Zambesi, consisting of over eight hundred, covering an extent of two miles of country, their course would be marked by utter desolation. The havoc thus caused is not however perceptible, a fact which that observant traveller has attributed, no doubt rightly, to the care shown by the elephants in the *selection* of their food—a point, as he justly remarks, often overlooked in estimating the *quantity* of food required by the larger animals.

Again, all these animals, rhinoceri and hippopotami included, are, as M. Krapf observed, the true pioneers, "the real pathmakers of the tropical forest, which without their tracks would be often utterly impenetrable to man." Further, these paths leading as they most frequently do, to water, are often the *only* open channels for the surface-flow of the heavy rainfalls, and thus materially contribute to the continuance of the water supply of the district, to the very existence of which they owe their formation. While the elephant does not thus destroy vegetation which would ruin the shelter which appears indispensable to him, on the other hand he directly assists the production of new growths by his habit of searching for the many succulent bulbs to be found below the surface of the soil in every open space.

Mr. Gordon Cumming, in whose time elephants were more plentiful in the neighbourhood of the colonial frontier, than they are at the present, described large patches of many acres each in extent, as being thus ploughed up to a depth of several inches by the tusks of the elephants in quest of roots and bulbs; thus doubtless bringing to the surface germs of a fresh vegetation which would otherwise lie dormant. It is

curious to remark that Pliny was acquainted with this habit (generally overlooked by modern writers) and he describes the "Indians" (?) as sowing their corn in the furrows thus provided for them by the elephants.

We have already alluded to the influence of locality on the size of the elephant, and the same remark appears to hold good with other animals. Many of the so-called varieties of antelope are asserted by Dr. Livingstone in a note to his last work to be but local variations of other species already known. The same remark applies to the carnivora; the varieties of lion, the yellow and black, as they are styled by the colonists, thus appear to be one and the same animal at different ages and under the influence of different localities; the darker colour coming with age, and the thickness of the coat and the shagginess of the mane being apparently in a great measure dependent on the nature of the cover frequented by the animal.

Mr. Frank Buckland, in his interesting *Curiosities of Natural History*, Second Series, relates two curious circumstances showing the subtle occult influences of locality on animals when in confinement. Animals in travelling menageries, he informs us are, as a general rule, more healthy than those confined to one spot, as in the Regent's Park collection. This, too, is shown especially during gestation and parturition. Again, of several pairs of lions (from different places and kept always apart) which were successively placed in one particular cage in the Zoological Society's Collection, the lionesses in each case produced cubs with a singular malformation of the palate of the mouth, the cause being, it is needless to say, inexplicable.

We may here briefly refer to the effects instanced in the case of those two formidable foes of domestic animals the "fly," or tsetse, and the lung sickness or peripneumonia of South Africa, both of which appear so dependent on locality. The "tsetse" is a small active bee-like insect found in certain regions only, which sucks, in mosquito fashion, the blood of every creature it comes across. Its bite is harmless to man (even to the smallest children), to the mule, ass, and goat, to calves while sucking, and to all wild animals; yet it is certain death to the horse, ox, and dog; the symptoms, which last for months, pointing apparently to a strong poison introduced into the system. The localities in which this formidable pest is found are very circumscribed. Dr. Livingstone relates that although the south bank of the river Souta was a noted "fly" district, he found on the north bank the plague was unknown, the river being scarcely fifty yards wide, and tsetse being frequently carried across on the bodies of dead game by the natives.

Again, peripneumonia, known as "lung sickness" when it attacks the oxen, and "horse sickness" when it affects the horse, which is in fact the rinderpest of which we have of late had so much bitter experience, and which is equally fatal to domestic cattle and to the bovine antelopes and quaggas, appears unaccountably to be restricted to certain localities. In some parts of the Cape Colony there are very limited tracts of moderate elevation which appear to procure for horses while kept there a perfect immunity from the attacks of the disease from which they have acquired from the Dutch the name "Paarden bergen," or horse hills.* They appear to possess no *peculiarities* of soil, vegetation, elevation, or climate to distinguish them from other spots around, and the cause of the immunity they enjoy remains as obscure as when it was noticed by the Dutch traveller Sparmann a century ago.†

A remarkable instance of the influence of the animal on the vegetable world, occurs in the migrations of game which annually takes place, from the desert towards the Cape Colony and Natal. In some cases these may be due to the state of the herbage, which varies considerably at different elevations, but in the more marked cases as the migrations of the spring bok (*Antilope euchore*) this is not the case. These animals leave the desert at the time the grass is *best*, and track down towards the colony. The difficulty of estimating the numbers of a herd of animals in movement is always great; indeed, during the frontier struggles with the Kaffirs, it was always remarked that the number of cattle driven off or recovered, was in every case overrated by the most experienced stock keepers, even where no object was to be gained by misrepresentation. With these antelopes the difficulty is greatly increased by a certain quivering motion of their horns which they maintain, and also by the gleams of white from the beautiful fan like manes which extend along their backs, and which they invariably erect when moving; considering, however, the great numbers afterwards found in the colony when the main body has divided, it appears probable that the estimate which places the numbers at between

* There are certain localities in India which appear to be similarly endued in respect to cholera. These have long been known to the natives who suppose them to be under the protection of a "swamy," or deity. The credit of *first* having called attention to these spots, we believe belongs to Colonel Haley, H.M. 108th Regiment, who has recently referred to them in the *United Service Magazine*.

† This disease, which is endemic in a part of the Trans-Vaal territory, becomes annually epidemic throughout a considerable part of the Cape Colony and Natal. Horses which have once passed through the disease are termed "salted," and are supposed to be safe from future attacks, a security which in the case of oxen is sought to be attained by inoculation with a portion of the diseased lung of a dead ox inserted in the fleshy part of the tail, near the root.

thirty thousand and forty thousand at starting,* does not exceed the truth. On certain seasons, generally recurring about once in ten years, there is a vast increase in numbers which causes the movement to take some of the features of an American "stampede." We have ourselves witnessed instances on these occasions, when the animals hurried along and seemingly bewildered by the numbers round them have allowed themselves to be caught by the hand.

It is to these larger occasional migrations that the Dutch Boers more especially apply the term "trek bokkens."

A scarcity of food in certain seasons inducing greater numbers thus to migrate, is the cause usually assigned to these movements, but there is another which we think may have at least an equal share in producing them. These animals are polygamous, consorting in the proportion of four or five females to one male. Now it has been asserted with apparent truth, in the case of animals in a state of domestication that the proportion of the sexes born in different years varies considerably, and it is we think likely that these "trek bokkens" take place when the numbers have been increased by a large preponderance of females born a few seasons previously.

Dr. Livingstone assigns another cause, viz., the wary habits of the animals which induce them to leave the high and rank grass and choose more open feeding grounds, an instinct by the way, often displayed by domestic oxen.

Wherever the herds of antelope are found, whether the numbers be large or small, they appear materially to influence the herbage of the district they frequent. Their close, cropping bite resembling that of sheep, opens out a place for the young shoots, while their droppings not only fertilize the ground, but return to it the seeds in the form most suitable for fecundation.

Dr. Livingstone has related some instances where the game having been destroyed, the grass totally disappeared, being succeeded by a growth of mesembryanthemum-like plants, a change, which it is needless to say, would materially affect the water supply of a scantily watered country.†

* They have *never* been noticed returning to the desert.

† The difference in the quality of the flesh of different closely allied varieties of antelope feeding on the same herbage is noteworthy; while the flesh of some is tolerable venison (as the spring bok), that of others (as the rhei bok) is rank carrion. This reminds us that the Dutch colonists have a curious idea respecting the varieties of the common hare, which are very numerous. These animals, they maintain, feed on garbage, an idea certainly confirmed by the places they appear to frequent. To give an example of this habit in a herbivorous animal, the writer remembers many years ago in Lisbon, seeing the goats feeding in the vicinity of the city muzzled, which he was informed was done with a view to prevent their feeding, as they would, if possible, on the offal and impurities that fill the purlieus of that dirtiest of dirty cities.

The migratory habits of these animals also prevent the herbage, and consequently the water supply, of any particular district being affected by over-cropping. In the Cape Colony, near Graaf-Reinet (and, we have been told, in some of the Merino districts in Spain), the reverse of this picture may be seen. In these cases, by *over*-feeding certain of the sheep-walks, the herbage has first become impoverished, and in the end, like the water supply, has nearly disappeared.

The numbers of these animals are also kept in check by the large proportion of the carnivora. Lions, indeed, are getting scarce; but the various species of leopard and tiger-cat, known to the colonists under the general name of tigers, and of hyænas (called wolves), is still very great. The beneficent purpose these animals fulfil in the great scheme of nature, has been so admirably pointed out in the "Bridgewater Treatise" of the late Dean Buckland, that although our limits forbid our transcribing it, we cannot help begging the reader to turn to it.

It is, indeed, trite and superfluous to say that this intimate relation between every department of nature may be traced by the attentive observer upon every spot on the earth's surface, but in South Africa it possesses an additional interest from the consideration that while on the one hand (if the surmises of recent geologists as to the antiquity of the present state of the South African continent be correct),* there is no region we can point to where those relations AS THEY NOW EXIST, have been longer in force; there is on the other none where the retreat of animal life before the almost imperceptible encroachments of civilized man has been and is progressing in a more marked or obvious manner.

* See Sir R. Murchison's remarks on the South African continent.

THE PLANET SATURN.

(CONTINUED.)

BY THE REV. T. W. WEBB, A.M., F.R.A.S.

BEFORE we proceed to review the anomalies exhibited during the lateral presentation of the ring-system, we must take some notice of an idea to which Secchi was conducted by the singular disagreement of the measures which he obtained of it in its more open position. This eminent observer was induced by Σ II.'s suspicions as to the permanency of the ring, and the remarkable differences between the results of the first astronomers—Lassell, Encke, and Galle having given upwards of 1″·5 more than Bessel to the outer diameter of the whole—to use the micrometer largely himself. He found his values on any given evening very accordant among themselves, their discrepancies ranging within 0″·3; on different ones perplexingly the reverse, much more so than in the case of double stars; for instance, as the extremes of sixteen nights, 1855, Dec. 15, 41″·443; Dec. 27, 40″·412. A comparison of these variations, which he found in some respects corroborated by the observations of Lassell, Main, and De la Rue, led him to reflect whether the ring, as a whole, might be subject to periodical dilatation, or might be elliptical in form, with a rotation sometimes presenting to us its longer, sometimes its shorter axis. Of these two suppositions he thought the latter the more probable, suggesting a period of about 14h·238; but on the whole considered that there might be not merely ellipticity and rotation, but some actual variation in diameter; hence concluding that there is no reason to fear, with Σ II., a progressive alteration and final destruction of this "beautiful accessory" to the planet.

These last expressions of Secchi refer to a singular and impressive speculation of Σ II., who, from a careful comparison of the ancient drawings and measurements, such as they were, of the ansæ and the included space with more modern values, had been induced to believe that the ring-system, especially the inner edge of B, was in a state of such perceptible and rapid approximation to the planet that its ultimate disintegration was now not only a mere question of time, but, as it would seem, of a comparatively short interval. More recently, however, the improbability of this curious hypothesis has been shown by the measurements of Main (then Senior Assistant at Greenwich, now Radcliffe Observer at Oxford); and the ideas of both Σ II. and Secchi, though too interesting to be passed unnoticed in a recital like the present, have been so strongly

controverted by Professor Kaiser of Leyden that it may not be necessary to refer to them at greater length. We may, however, make the passing remark, the justice of which will be evident on more than one occasion, that the almost unapproachable mystery of the whole subject permits a latitude of speculation much more extensive than would be accorded in questions of a less obscure and perplexing character.

The want of symmetry which has led to these remarks is, as might be anticipated, not less evident during the lateral presentation of the rings. From an early period we meet with observations of anomalous appearances at these epochs, comprising not merely differences in the relative visibility of the two ansæ, but also other variations of aspect, all bearing similar testimony. As far back as Dec., 1671, the two Cassinis had seen Saturn attended by the blunted remainder of only a single ansa, and this not always on the same side.—1714, Oct. 1, 3, 5, 7, 9, Maraldi found the E. ansa rather the broader and more visible, while each, evidently from want of optical power, seemed reduced to one-half its usual length; 12, only W. was visible; 14, disappearance complete.—1715, March 22, a trace of W. only.—1743, Nov. 29, Heinsius found E. shorter than W.—1773, Sept. 24 to Oct. 4, Varelaz at Cadiz with three telescopes, one a 5-ft. reflector by Short, saw distinctly W. constantly brighter than E. ansa; he also remarked some more luminous points at the extremities; the first notice, it is believed, of an appearance frequently recorded in more modern times. Similar irregularities are stated to have been seen this year by Messier, who inferred much inequality of surface. Oct. 5, 6, W. only seen at Madrid.—1774, $\frac{11}{5}$ is stated to have seen only one ansa for some time. Jan. 11, Messier observed E. longer than W. Previous to its disappearance W. was seen the longer and brighter for four weeks at Mannheim; at its reappearance, Wollaston thought he detected W. June 30; July 2, he was certain of the whole, but W. was the larger.—1789, August 30, Ussher at Dublin found E. the more visible; Oct. 1, E. only. At Cork, E. only latterly to Oct. 5. Schröter perceived only a few luminous points till after Oct.; but 1790, Feb., in frequent observations incomparably more of them, in part at least not satellites. During twenty days he and another saw W. much brighter than E., which was far more irregular, and had on it the last two days a fixed point of light. Hence he concluded, as Messier and others had done fifteen and thirty years before, that the S. was by far the more uneven surface. [We have already mentioned that the fixed points or knots of light, which will now repeatedly be mentioned, though supposed by Schr. to be mountains, one between 400 and 500 miles high,

are no doubt, as Olbers suggested, the perspective projection of the brightest portions of the ring enlarged by irradiation; or if we are looking on the dark side, light reaching us through its openings. But their frequent absence of symmetry is the point to which we are directing our attention.] 1803, Jan. (3 ?) 4, Harding found W. ansa reappear alone, with a large knot of light. 11, Schr., Harding, and another found W. more visible, and the knot unmoved. 14, ditto, Schr. detected two smaller knots on E.; they observed by turns for 8¾h., and found them unchanged; during the latter days the W. knot began to lengthen westward; it continued visible and unmoveable for 4½ months. June 10, all E. had disappeared except two points, W. was extremely thin and interrupted, with its great point or *mountain*. 16, Schr. saw W. with much difficulty; E. had for some time disappeared. It vanished at last, even in 27-ft. reflector, and reappeared on each side alternately as a fine interrupted line. Nov., ring knotty, E. white, W. fainter; the same three spots. Schr. considered that when we looked on the S. side, W. was the larger, and the reverse, and inferred that the rings did not lie in the same plane.

I have found no record of its aspect at its next disappearance, but in 1832 and 1833 we have several notices, especially by Schwabe,* the great observer of the sun at Dessau. Dec. 1, he saw one minute point on E. side, fixed for 3h. so as to show that it could not be a satellite. 12, E. ansa had a bright spot (near outer edge of ring B), and did not close up to the ball; W. uniform, rather the shorter, broader, less defined, and fainter; but vanishing later behind clouds than E. The dissimilarity continued through the spring of 1833, but the spot grew less obvious on the widening ring, and the E. ansa became continuous, though feebly so, to the globe. April 2, ansæ evidently unlike; E. fainter than W.; both feeble. 7, 15, E. the longer; no brighter spots. 17, E. obviously the longer, and somewhat the sharper defined; very faint or invisible near ball, while W. closes up to it. 25, W. the more distinct; E. seems discontinuous. 27, ditto; sometimes, perhaps, a bright spot on E. May 1, ring gone. June 8, 13, sometimes very minute point E. 14, first certainty, W. somewhat the more distinct, and closing up to ball; E. does not close, but has a bright spot. 18, spot so bright as to make E. ansa, though the fainter, the more conspicuous. 24, W. very obviously the shorter and fainter, but uniform; E. brighter towards extremity. 25, ditto; the spot seemed double. July 16, W. uniform; E. distinctly longer, and very faint next

* This name was erroneously printed *Schuzbe* in our last No.

globe; spot more extended. These observations were confirmed by others. Petersen at Altona found E. always considerably the brighter. April 22, 25, 26, a distinct bright point E.; another, not symmetrical, suspected W. At reappearing, June 16, Bianchi saw bright points in ansæ. 19, a point. 22, 24, several, E. Santini, 18, E. like a string of pearls, dissimilar to W. Mädler also saw a brighter point E. than W., and W. took the lead in the apparent shortening of the ansæ.

During the decrease of the ring in 1846, from Nov. 21, Schwabe found W. always rather fainter and less sharply defined than E.—1847, July 11 to Aug. 15, W. somewhat the more distinct, bright, and long, and its "lunule" more obvious, though not larger: from middle of Sept. both ansæ equal in all respects. At the ensuing edge-presentation in 1848, a greater degree of systematic attention was paid to these appearances, and the experience of Schwabe, the keen eye of Schmidt with the 8-feet Bonn heliometer, the unsurpassed vision of Dawes, and the extraordinary power of the achromatic at Harvard College, U.S., were all put in requisition. June 26, the dark side being turned towards us, the ring was visible in its whole length, but not continuous W.:* Bond II. Traces rather plainer E. as a multitude of the finest points: Schm.—June 30, 2 faint dots, E. the plainer, about the extremity of ring B: Dawes.—July 3, W. more distinct than E.: Bond I.—10, an interruption and two bright points on each side: Bond II.—11, three detached bright portions W., two E.: Bond I. Continuous, but brightest in four places, like satellites strung on the ring, only fixed: B. II.—14, 16, 17, breaks visible, B. II.—15, as before, Dawes.—18, composed of fragments, but more continuous, and broadest near ball W.: B. I.—21, 4 fixed points: B. II.—Aug. 29, W. the more easily seen; 2 spots on it; one only on E.: B. II.—30, W. best, with a spot: B. II.:—31, unequally illuminated: B. I. II.—Sept. 3, sun passed to S. side: ring perhaps beaded: B. I. II.; probably not equable, yet not dotted as June 26: Schm.—4, perhaps not quite equable, but prominences and interruptions not perceptible; thinnest next ball: B. II. W. somewhat the plainer; E. interrupted: Schw. W. seen without any difficulty interrupted in 2 places; E. less certainly so: Schm. [personal or instrumental equation must come in here]. E. decidedly longer than W.: Dawes.—5, ring a sharp line, thinning off from W. to E. end; W. most obvious, and joining globe; E. interrupted and not joining: 2 bright longish thickenings on W., one sharp point on E., all fixed: Schw. and Habicht. W. in-

* *P.* in original, as in many other places.

3 portions; E. in 2: Schm.—6, much the same: Schw. One break on each side at place of Ball's division; E. somewhat the longer: Schm.—7, the same: Schw. and Hab. E. the longer; Schm. who saw one break E. 2 W., so Argelander, who did not think them quite dark.—8, W. and 2 spots plainer, E. and point weaker: Schw. and Hab. 11h. 15m., break in each ansa, near Ball's. div.: 12h. 15m., W. the broader as before, E. the longer with 2 breaks; 14h. (very fine, power 600) W. in 3, E. in 2 parts, but all W. broader, brighter, and stronger,; E. perhaps longer and very pointed: Schm.—9, W. very broad, points well divided; E. narrower, but of sharper light, showing besides old point, 2 fainter ones nearer globe, from which to the nearest was an extremely faint line. It seemed as though both ansæ were not in one plane, but E. was a little sloped towards S.: Schw. One break, probably more, on each side; proportions E. and W., as yesterday: Schm.—10, the same in all respects: Schw. and Hab.—11, W. only one longish thickening; E. three points: Schw.—10, 11, break on each side; E. the longer: Schm.—11, no prominences: B. II.—12, W. certain; E. nothing but 2 extremely fine points: Schw.—13, Earth passed to dark side; W. perhaps visible close to ball: B. II.—18, ring extremely delicate; W. 2 fixed points: B. I.—Oct. 5, interrupted, especially W.: B. II.—6, 7, rather broken, especially E.: B. II.—12, disconnected, and 2 points: B. II.—20, 23, inequalities as in July: B. I. II.—28, the dark part across the ball uneven: B. I.—Nov. 3, symmetrically interrupted, but broader E.: B. I.—13, 29, dark part uneven: B. I.—1849, Jan 6, brightest E.: B. II.—19, after earth had passed to illuminated S. side, ring rough, broken and not joining ball and longer E.: B. I.; these differences not perceived: B. II.—21, W. unquestionably the broader, but less defined and fainter, broadest at end, and with a knot of light; E. carried 2, possibly 3 points: Schw. A strong point at end of E; doubtful whether ansa touches either it or ball; fainter and less distant point on W. which touches ball: Schm.—27, W. uniform; points on E. doubtful. E. seems longer than W., and not joined to globe: Schw.—29, ditto; greater length of E. obvious: Schw.—31, no points, but ansæ very unequal; W. evidently the shorter, less defined, and fainter; yellowish; E. orange; joined to ball by a feeble line: Schw. Günther in Breslau, 1848, Sept. 5, found ansæ disjoined from ball, and E. distinctly brighter than W.—Sept. 7, Busch at Königsberg saw a fixed point at the very end of E., one nearer ball on W. So Wichmann.—8, point on W. invisible; on E. somewhat nearer ball.—9, 10, point at end of E.—11, W. brighter than E.

The observations at the last epoch of similar presentation,

1861-2, were, as far as I have seen them, of the same character. As the ring diminished, Secchi found, if the air was not good, E. ansa sometimes the shorter. Nov. 8, both were short, but especially W.; E. the fainter. 15, ansæ dotted; E. much the narrower. 19, E. "apparent" ansa (qy.: does not this mean the real W. in an inverted field?) certainly the shorter. [We must not forget that these differences in length which so repeatedly come before us, may be as fairly ascribed to excentricity, as to deficiency in reflective power of the extremity of the line.] During the following observations by Schwabe, with 6ft. Frauenh. up to 360, the earth was on the sunny side of the ring.—Feb. 7—10, both uniformly smooth, E. growing brighter. 17, W. very blunt-ended; E. with 5 or 6 fixed knots, 2 strongest very near ball. 18, 19, W. the shorter; E. dotted and very pointed. 27, E. still dotted. March 1, 8, W. a little the more distinct. 10, both alike bright, long, and smooth. The dark spaces begin to appear as 2 very fine black lines. [This seems inconsistent with any appreciable thickness of C.] 12, ditto. Ring begins to be brighter than ball. 15, 16, 24, ansæ unchanged. April 1—8, W. less defined and shorter than E., which had a granular light. 10, E. obviously the longer. 14, E. very pointed and somewhat knotty. 15, E. certainly the brighter. 22, E. alone knotty. 24, E. so sharp that its termination is sometimes doubtful. 25, ditto; W. the more distinct. 29, E. end often vanishes. 30, 2 knots on E., and its end fainter. May 1, E. had 2 knots; it often vanished. 2, a third knot E. 3, E. the feebler; no knots. 4, 5, W. the plainer. Throughout these observations, from Feb. 7 to May 2, the ansæ preserved invariably a wedge-shaped aspect, tapering from W. to E., as Schröter had represented it in a "rough but very faithful" design; whence Schwabe infers that, whatever explanation may be given of the dots of light, rotation is impossible.—1861. Wray 7 in.: Dec. 17, line irregularly broken (looking on dark side); 26, 16h. 30m. E. scarcely, W. readily visible, and broken in 2 places; 18h. 30m., both equally bright; 19h., E. the brighter. Jan. 4, W. much broken, brighter than E. 5, 13h. 30m., W. much fainter and shorter than E.; 16h. 40m. equal in length and light; 17h. 15m. to 18h. W. decidedly the brighter. 18, ansæ equal. —1862. Huggins, May 2, 12, 13, two bright dots E. at inner and outer edges of ring. 16, ansæ steady; no dots.—Carpenter at Greenwich, May 5, E. $\frac{1}{10}$ the longer. 17, W. just visible; only one spot E. 19, W. the more visible.—Birt, May 13, with 2 achroms. by Slater, 3 beads W.; 4 (Slater 5), E., which was the longer.—Σ II. May 16, W. the longer as 5 to 4. 17, 18, 19, W. the more visible. June 3, perhaps the shorter.

The unvaried bearing of all this testimony is in favour of

the conclusion, already adopted by some of the very early observers, that, instead of the whole ring-system lying in an uniform plane, there must be a slight degree of mutual inclination in the surface of its subdivisions, and such an inclination as will occasion want of symmetry in its perspective projection.* This would not be the result of mere inclination, so long as the intersection of the planes, whatever might be their number, passed through the centre of the planet, because one half of each plane would be as much elevated as the other depressed on either side, like the ecliptic and equator in the sky, and symmetry would not be interfered with. We must, therefore, in order to explain the observed appearances, adopt the idea of planes whose intersection does not pass through the axis of Saturn—perhaps not even through any part of the globe, or ring-system itself; and whose varying inclination—for under the action of so many disturbing forces, their inclinations and nodes must vary—though symmetrical on either side of their own intersections, or *lines of nodes*, would not be so on either side of the centre of the planet. Such an arrangement would not involve any theoretical impossibility. It is not essential to the stable equilibrium of the whole system, that the centres of gravity of the several rings should coincide with that of the planet; so long as this is the case with the common centre of all, they would individually balance each other on opposite sides of it. And even a want of coincidence between the common centre of gravity of the rings, and that of the planet, would not produce disintegration of the system, provided each of those points revolved round an intermediate one, the general centre of gravity of the whole. The mutual attractions, however, of the rings, and the external influence of the satellites, while not of necessity causing any permanent derangement or ultimate collapse, would yet introduce a complexity of balancing, the result of which would probably transcend all human analysis, but which may *possibly*—more cannot be said—produce the peculiar variations which the foregoing details record, and which certainly are supported by too great a mass of evidence to be treated as mere optical deceptions. Theoretical inquiries, however, unless of the most superficial and familiar character, lie wide of our present object, which is simply to bring into one point of view the most accessible data, that the student may, as the result of a

* Bessel found by strict mathematical investigation that the times of the disappearance and reappearance of the ring were incompatible with parallelism in its opposite surfaces. But this, though harmonizing with the wedge-shaped form recorded by Schwabe, is scarcely an adequate solution of many of the recorded phenomena, and at any rate merely treats the system as a whole. Cassini II. had anticipated this conclusion.

careful comparison, ascertain for himself, what is pretty certainly known, and what is still ambiguous, in this wonderful subject.

To explain the variety of appearances, it would seem necessary to assume that Ball's is not the only actual division in the system, but that the minuter dark lines which have been often noticed, indicate its separation into many narrow concentric annuli. This is in every respect probable, and it is not impossible that the difference so frequently recorded in the visibility of these divisions on opposite sides of the globe, may be due to some of the perturbing influences to which we have alluded, and which may really, in the inscrutable arrangements of an all-wise Creator, be the source of preservation instead of ruin. Such at least was the opinion of Pierce, who considered that, without the compensation introduced by the influence and position of the satellites, not even the irregularities of the ring, to which Laplace had referred its equilibrium, would suffice to guarantee it from collapse and destruction.

The variation of inclination among the bright portions is obviously confined, as we must have remarked, within narrow limits, and disturbs the symmetry but in a small degree. But it may be questioned whether this may not be more the case with regard to the dark ring C, as well as whether it may not be of considerably greater thickness than its neighbours. Σ II. thinks both of these probable, from the visibility of what Maraldi called the equatorial belt during the disappearance of the ring in 1715. This, however, does not seem conclusive, unless it can be shown that he was not then looking upon the unenlightened side of the bright rings. But at the first discovery of C in 1850, Dawes remarked that it was always more plainly seen behind than in front of the ball, and that its projection upon the ball was then considerably too narrow to accord with that at the major axis; and more conspicuously so at that time, than at the end of 1852. These appearances, he says, might be satisfied by the supposition of a wedge-like form in C, the thick edge outwards, and a similar but reversed form of B: he preferred, however, the hypothesis of De la Rue of a different inclination for C, which would thus be tilted up, as it were, from behind towards the eye. De la Rue, in fact, in his first beautiful engraving, Nov. 1852, represents C as encroaching on the outline of B behind the ball; and in his second continues to show it wider there than in front:* he

* Lassell, on the contrary, at Malta, with 24 inches, found, 1852, Dec. 15, C so broad, and B so narrow, in front of the ball, that he thought the darkest part of the latter must have been merged in the appearance of the former.

considered, too, that its apparent ellipticity was not the same with that of the bright rings. Mitchell also, with the 12-in. achrom. at Cincinnati, noticed the disproportionate breadth at the major axis; and I thought it evident with 5½ in. in June, 1865.

The very curious comparative indistinctness of the E. edge of ring B, observed by Schumacher and Dawes (INTELLECTUAL OBSERVER, ix., 371), struck Mr. Barrow, the companion of the latter, 1855, Dec. 19, as an indication of an inclination in the plane of C.—1857, Jan. and Feb. Morton, observing with Lord Wrottesley's achromatic of 7¾ inches, found the division of B and C never well marked, from the apparent overlapping of the latter, the opposite or inner edge of which was sharply seen. But still more curious are the observations of the eminent optician Wray and Σ II., in 1861-2, when the edge of the ring was presented to us. The former, using a 7-inch object-glass, distinctly saw, Dec. 23, 26, Jan. 4, 5, 11, 18, a faint, nebulous, bluish-white light, very different from the planet in colour, attending each side of the narrow ring-line for about ⅓ of its length right and left of the ball. The latter, May 15, perceived luminous appendages like clouds of less intense light, lying on the S. side of the line, which was much sharper defined N.—19, they extended 0·6 *p*, 0·3 *f*, of the diameter of the ball; their colour very unlike that of the ring, being "not yellow, but more of a livid colour, brown and blue." 20, extent 0·65 *p*, 0·5 *f*.—21, 0·6 *p*, 0.4 *f*, on which side light much more feeble; breadth increasing towards limbs like sharp wedges.—22, 0·6 *p*, 0·5 *f*,—June 3, very bad image, yet appendages still distinctly visible. Winnecke concurred in these observations. Nothing of the kind, however, was noticed at Greenwich, May 17, 19, 20, June 3. During Σ II.'s observations the sun was nearly in the plane of the ring; more elevated during Wray's, when the earth, on the contrary, was much lower.

Our readers may have remarked that nothing has been said as to the period of the rotation of the ring, which, as is well known, was deduced by H, in 1789, from the luminous points of which such repeated mention has been made. He fixed it at 10h. 32m. 15·4s., and the dissentients from so high an authority have been very few. Schröter, indeed, from the unmoved position of certain protuberances; Schumacher, from the unvaried difference in sharpness of the inner edges of B; and Schwabe, from the unchanged direction of the wedge-like form of the lateral view, have not hesitated to express a doubt even as to the fact of rotation; but the generality of astronomers have acquiesced in H's determination both of the fact and the period: and it would seem to involve no small degree

of hardihood, not to say presumption, for any but a great leader in science to call it in question now. But truth ought to be paramount to such considerations. It is not authority but fact with which we have to deal. It is not so much a matter of opinion as of evidence, and a circumstantial examination of the original observations seems to bring with it the inevitable impression that they are not adequate to bear out the conclusion which has been drawn from them. The lucid points which have been so often noticed, strung like beads, to use H's elegant illustration, upon the ring, may be referred to more than one cause. If fixed, the reasoning of Olbers and the measurements of Bond concur to prove that they are merely perspective foreshortenings or transmitted glimpses of the brightest portions of the ring, and their frequent want of symmetry offers, as we have seen, no insurmountable impediment to this explanation, in default of which they would be irreconcilable with any rotation whatever. It is only among such as are moveable that the indications of rotation can be sought; of these the greater number are confessedly merely satellites projected upon the line of the ring, and it remains to be inquired whether there are any others which cannot be accounted for in this way. Now, in 1789, after the discovery of the two innermost satellites, H found in the record of his observations that in 47 instances, extending through 20 nights, he had seen bright points not concurring with the position of any satellite at the time. The idea of their being mere results of perspective, or openings in the dark side, had then never been suggested, and he does not seem to have contemplated the possibility of their fixity: he therefore assumed the existence of 5 separate spots—which he preferred to consider as outbreaks of fire rather than as mountains—in different positions on the ring; and he proceeded to show that his observations might all be accounted for by a combined rotation of these hypothetical spots in rather more than $10\frac{1}{2}$ hours. This, it may be safely asserted, is a mode of proof which is entitled to little confidence. But, it will be asked, did he not actually witness their motion? That, it is obvious, would be the only satisfactory test. A point on a ring revolving with such rapidity would be carried through its whole apparent length in $5\frac{1}{2}$ hours, or through a space equal to the radius of the planet in about 1h. 10m., and, though considerable allowance must be made for the perspective foreshortening of the direction of motion, it is evident that among so many observations it ought to have been repeatedly perceived. But in two instances only is anything of the kind distinctly specified. Oct. 30, 20h. 53m. distance $\frac{1}{4}$ diam. of planet *f* (but this he is obliged to refer to a different hypothetical spot):—23h. 55m. $\frac{3}{4}$ ditto *p*, very near the end of the arm:—0h. 42m. a little nearer than before:—

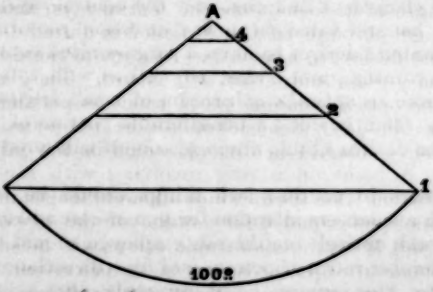
0h. 47m. ⅓ again.—October 31, 21h. 13m. ⅓ *p*:—22h. 11m. drawn nearer; "flying clouds prevent estimations of the distance."—23h. 13m. "no longer visible." From such very limited and incomplete data it does not seem too much to say, with all due respect to the illustrious observer, that no exactness of period could be deduced. And nothing has since been added to them. In an accompanying diagram the imaginary spots are set nearer to or further from the edge of the ring, to make the calculations correspond with the appearances; but he expressly states that his period applied to the exterior ring A. Laplace had previously given about the same value, but for the *interior* ring.

(*To be continued.*)

A near appulse of the moon to Saturn during the evening of Aug. 16 will be an interesting spectacle, the distance, at Greenwich, being only 36′.

ROSS'S FOUR-TENTHS CONDENSER.

The subject of achromatic condensers for the microscope is not yet exhausted, and although several forms of considerable merit are now before the public, there is still room for experiment and invention, both in the glasses employed and in the nature of the stops. Mr. Ross has added to the number of condensers one that especially deserves notice and commendation; and, we think, after giving it a considerable trial, that it will be regarded with great favour by practical microscopists.



Before describing the new condenser, we must say a few words on the different results which proceed from employing combinations of different sizes and different degrees in angle of aperture. Let the microscopist draw two lines converging and making an angle of 100°, and then draw, at various dis-

tances from the angle, horizontal lines uniting the two lines that converge to form the angle. The figure will be like the preceding diagram, in which A represents the focal point of a series of lenses, 1, 2, 3, 4, of different sizes and focal lengths. Each lens, 1, 2, 3, or 4, can throw, through any transparent substance, appropriately situated, rays of light which converge at an angle of 100°; but there will be a great difference in the total quantity of light which each lens can receive or refract, and also in the proportion which the marginal rays bear to the central ones. In 1, the marginal rays will be greatly in excess of the central rays; while in 4, as the marginal rays are fewer, and the central rays the same, the latter will be relatively much more important. This diagram distinctly expresses to the eye the fact that, when achromatic condensers are made with small lenses, the marginal rays do not exceed the central rays to anything like the same extent as when larger lenses are employed.

Suppose the diagram to be on such a scale, that the lens, whose diameter is represented by 2, will focus through the thickness of an ordinary glass slide, it is then plain that lenses of the same aperture, and so small as either 3, or 4, cannot possibly perform with their whole aperture, or anything like it, through the thickness in question. A lens of given aperture and of focal length greater than the thickness of a glass slide, may converge all its rays through any transparent object on the slide; and if the slide be much thinner than the length of its focus, all the difference is, that the thin glass will obstruct and refract the passage of the rays less than the thicker glass. If, however, we try to make a large-angled and small lens with a short focus work through a slide, the thickness of which exceeds the length of its focus, only the central rays, and those near them, can get through in the direction required. Thus, if a microscopist desires to have a large-angled condenser, for use with ordinary glass slides, as well as with thin glass, he must not take an optical combination of small lenses and very short focus, for if he does, a considerable portion of the slanting light he desires should reach his object will never get there at all.

It appears to us that two things should be required of achromatic condensers intended for general use and for *research*. First, that the optical combination employed should be adapted to a considerable range of power—say from an inch or two-thirds upwards to the highest; and, secondly, that it should be capable of working with a large aperture through ordinary glass slides. When low powers are employed, a pleasantly lit field can be obtained, by using a condenser a little out of focus, so that the rays cross before reaching the object; but a condenser for general use should be able to send

a sufficient quantity of its oblique rays, when in focus, through an object seen with very moderate magnification, and should be capable of giving a dark ground illumination with a half inch or two-thirds object glass.*

In Mr. Ross's four-tenths condenser, the principal desiderata are excellently provided. The optical combination is exactly the same as in his large angled four-tenths objectives, and the front lens has a diameter of one-fifth of an inch. In the best condensers the diaphragms are brought close to the lower lens, and this is the case with the instrument before us, which is provided with two revolving wheels of diaphragms. The upper one is pierced with eight round holes, or "circular apertures," as those who prefer learned phraseology may call them. One of these is, in point of size, a copy of its next door neighbour, and may be filled up with a polarizing slice of tourmaline, or may be made with a little rim, so as to receive any experimental stops the microscopist may wish to try the effect of. Omitting this stop, we have seven other stops, marked respectively 109°, 95°, 82°, 70°, 59°, 49°, and 40°. These stops allow the lenses to work with the angles of aperture named. In the wheel of diaphragms, below them, is another set of stops, which can be combined with the preceding. A, the first, is a large central stop adapted to 109° or 95° angles of aperture. B and C, smaller ditto; 3, 2, and 1 are *radial* stops—that is to say, they are pierced with slots, three, two, and one respectively, cut so as to converge towards the centre of the circle, but not carried as far as the centre. The single slot stop keeps out the central rays, and allows a radial beam, including its proportion of marginal rays, to illuminate the object. This can be used with the larger of the open stops. The two-slot stop gives passages to two such pencils of light, one at right angles to the other, a plan very effective with certain diatoms and other objects. The three-slot stop allows the transmission of three pencils, equidistant from each other. This gives the three readings of the *P. angulatum* beautifully. The arrangement for working the diaphragms in the condenser is very convenient, and the whole apparatus rotates with Mr. Ross' substage. The lenses are capable of adjustment to suit different thicknesses of glass.

Let us say a few words on the results. The proportion which, from the size of the front lens the marginal and central rays bear to each other is such, when the stop, allowing 40° of aperture is employed, that the two sets of lines, on *Pleurosigma hippocampus*, and *P. angulatum*, are distinctly shown with a one-fifth objective and first eye-piece. A slight change in

* With a two-thirds, we find it advisable to send the light through the four-tenths condenser with the *concave* mirror, when a dark ground illumination is required.

the position of the flat mirror makes this stop work excellently with the *podura* scale. Thus this arrangement enables an experimenter viewing a *new object* to see surface markings, and to obtain penetration with one and the same stop, an important gain in original investigation. For lined objects, other combinations will do better, but it is remarkable how well distance lines can be shown with only 40° aperture of the condenser, and no central stop at all. The slot stops have been found very useful in investigating unknown objects, as well as in displaying those that are known; and with the whole aperture and the two-slot stop many diatoms with double sets of lines are brought out very powerfully. The microscopist will find that from 40° to 59° angle of aperture will, in many cases, give the best results, when a one-fourth or a one-fifth objective is employed, though a larger aperture would be desirable to display the same objects if another condenser made of smaller glasses should be used.

LARTET ON THE ASPHALT OF THE DEAD SEA.

The following paper of M. Louis Lartet will be found in *Comptes Rendus*, No. 26, 1866:—

"The ancient traditions concerning the appearance of bitumen on the surface of the Dead Sea bear testimony to the evident connection of this phenomenon with the persistent activity of the internal forces of the globe in this region, and which have given rise to profound dislocations of cretaceous and nummulitic rocks, to the flow of volcanic matter, and to thermal springs. In our own times, some travellers who, like the American missionary, Smith, had the advantage of knowing the Arabic language, have been able to obtain, from tribes actually stationed in this region, tolerably consistent accounts of the more recent appearances of bitumen in the waters of the Dead Sea. It seems that the appearance of this substance is always preceded by subterranean commotions. Thus, after the earthquake of 1834, a considerable mass of bitumen made its appearance at the southern end of the sea, and the Arabs detached about 220 quintals, out of which they made a good profit.

"In 1820, when another earthquake destroyed a great part of the city of Tiberias, and occasioned the death of more than 6000 inhabitants of the district, very violent shocks occurred in the direction of the great axis of dislocation of the basin; new hot springs uprose in the Tiberiad; and a few days after-

wards the Arabs saw a mass of bitumen floating on the Dead Sea, which they took possession of and sold in the bazaar in Jerusalem for 16,000 francs, being at the rate of 100 francs for a quintal.

"It is only along the western shore of the Red Sea that important deposits of bitumen occur. We know that Strabo mentions the existence, in the neighbourhood of Masada, of rocks distilling pitch. We think we have discovered the deposits to which the Greek geographer alluded, first in the ravine to the south of the hill of Sebbeh, whose summit is crowned with the ruins of the ancient Masada. We meet there with dolomitic rocks, the numerous cavities of which are partly filled with asphalt which must have been introduced in a fluid state, and gradually solidified, giving the rock the character of an asphaltic breccia. More to the south, and nearer the diggings of *sal gemmi* and gypsum of Djebel-Usdom, if we ascend Wady-Mahawat to the height of about 300 metres, we find the same cretaceous formations strongly impregnated with bitumen, which runs from their fissures, and sometimes forms stalactites of asphalt. At certain points the bitumen has cemented together the ancient alluvium resting upon the calcareous rocks, and has formed bituminous pudding-stones, fragments of which are carried by torrents towards the Dead Sea.

"To the north of Masada we find traces of bituminous emanations at Ras Mersed; and lastly at Nebi-Musa, at the north-western extremity of the sea, the most considerable deposits of bituminous limestone are found, and where cretaceous fossils (inoceramus, echinus, etc.) are associated with the remains of fossil fish. This limestone contains as much as 25 per cent. of bitumen; and the cretaceous beds which have been impregnated with it contain also in the same vicinity salt, veins of gypsum, and traces of magnesia. It burns easily, and the Arabs call it Hajar Musa, or Stone of Moses, and make use of it to light their encampments. The Christians of Bethlehem make religious symbols out of it, which they sell, under the name of Dead Sea Stones, to the numerous pilgrims who flock every year to Jerusalem for the solemnities of the Holy Week.

"In the valley of the Jordan there exists, at the same level, other deposits of bituminous limestone. Such, without doubt, are those of Tiberias, from whence, according to Hebard, arise the Hot Springs of Hammon, the situation of which we could not verify.

"At Hasbeya, near the sources of the river, bitumen shows itself, as at Nebi-Musa, in fossil fish limestones, but it is less abundant, although it was the only deposit regularly worked at

the time of the Egyptian conquest, when shallow pits were sunk and a tolerably rich deposit arrived at, the *debris* of which we found on the margin of the pits.

"Besides this series of bitumen deposits of which are ranged in *échelon* on the long axis of the basin of dislocation, as well on the western bank of the Dead Sea. As on reascending the course of the Jordan, we found considerable traces of it, at the same geological level, in the inoceramous limestones of Khalwet, in the Anti-Libanus, between Hasbeya and Rascheya, and even in the approaches to Damascus; but the alignments of these last deposits departed considerably from the direction of the axis of the basin of the Dead Sea to arrange itself along the chain of the Anti-Libanus, and to direct itself towards analogous deposits of Mesopotamia and Persia—as if they would serve to unite these last with the long series of bituminous emanations passing by the Dead Sea, the point of Sinai, and the mountain of L'Huile, in Egypt.

"Much attention has been given to the origin of the fragments of asphalt which the Dead Sea throws up on its banks, and from its analogy with that of Hasbeya, it has been thought that it was brought down by the waters of the Jordan, forgetting that although bitumen is lighter than the water of the Dead Sea, it is much heavier than that of the Jordan, and that this river must have deposited it on its own banks in the course of so long a journey. It has also been supposed that vast sheets of bitumen, accumulated at the bottom of the Dead Sea, after hardening, have become detached and floated to the surface. This hypothesis is not justified by the numerous soundings made by the American expedition, nor by those of the Duke de Luines' expedition in which we had the honour to take part.

"Lastly, Dr. Anderson had a notion that under the bituminous deposit of Nebi-Musa there existed considerable layers of asphalt, intercalated with calcareous rocks, and the prolonged outlines of which stretched under the Dead Sea, and yielded to the erosive action of its waters the specimens which travellers noticed on its shores. This opinion does not appear to us more admissible than its predecessors. We do not see why the fragments of bitumen dispersed on the banks, and of which no trace is found in the ancient alluvium or the ancient deposits of the Dead Sea, should not come in part from the *débris* of these floating islands of asphalt, as well as, perhaps, from the disintegration of the bituminous rocks which the waters of the Wady-Mahawat and those of Wady-Sebbeh bring down at certain seasons.

"As for the occurrence of bituminous emanations in the

bottom of the Dead Sea or on its shores, or along the Valley of the Jordan, we believe that they are connected with a system of thermal, saline, and bituminous springs which extend along the major axis of the dislocation of the basin. This conviction rests first on the alignment of bituminous deposits along the same axis on which we find the rare representatives of springs which seem to have been connected with extinct volcanic phenomena: secondly, on the presence, verified by M. Hebard, of bitumen in the limestones, from whence emerge the thermal and saline springs of the Tiberiad, in which Dr. Anderson found bromine associated with organic matter; thirdly, on the analyses of the water of the Dead Sea, which, according to M. Terreil, contains an organic matter having the characteristic odour of bitumen, and which is particularly abundant in the neighbourhood of Ras Mersed, whose odours of sulphuretted hydrogen are noticed by all travellers, and which is the place signalized for its bitumen by Strabo.

"As at Ras Mersed the bitumen has penetrated the fissures of the calcareous rocks on the banks, and is found in the saline deposits in a little grotto very near this point, everything leads to the supposition that there still exists one of those submarine springs which in former times emitted considerable masses of bitumen, and which now confine their operation to exceptionally enriching the water in bitumen, chlorides, and bromides, and so disengaging sulphuretted hydrogen gas.

"In thus unfolding the reasons which lead to the belief that the bitumen has been brought by the hot and saline springs, and that it has impregnated the limestones after their deposit, we do not intend to decide the question whether this bitumen has been brought up direct from the depths, or whether the hot springs met with carbonaceous matter in their course, and reacted upon it. It is known that there exists in the Lebanon, in the system of sandstones below the cretaceous rocks which are impregnated with bitumen, considerable masses of lignite, of which the analogues may have existed in the Anti-Libanus and in the Dead Sea. In this hypothesis, which supports the observation of traces of vegetation found by Dr. Anderson in Dead Sea asphalt, the heated waters may have been able to extract from the lignites their hydro-carbon products, such as M. Daubrée has been able to show in his beautiful experiments illustrative of metamorphism.

"However this may be, we see in the preceding facts a fresh confirmation of the laws of association, connecting deposits of bitumen with salt, gypsum, hot springs, and volcanic phenomena.

RESULTS OF METEOROLOGICAL OBSERVATIONS MADE AT THE KEW OBSERVATORY.

LATITUDE 51° 28′ 6″ N., LONGITUDE 0° 18′ 47″ W.

BY G. M. WHIPPLE.

1866. Day of Month.	Reduced to mean of day. Barometer, corrected to Temp. 32°.*	Temperature of Air.	Calculated. Dew Point.	Relative Humidity.	Tension of Vapour.	Temperature of Air. Maximum, read at 9·30 A.M. on the following day.	Minimum, read at 9·30 A.M.	Daily Range.	At 9·30 A.M., 2·30 P.M., and 5 P.M., respectively. Proportion of Sky clouded.	Direction of Wind.	Rain—read at 10 A.M.
	inches.	°	°		inch.	°	°	°	0—10		inches.
April 1	...	...	...	...	...	49·5	36·6	12·9	...	... ...	0·065
„ 2	29·435	38·2	36·4	·94	·248	47·4	35·8	11·6	10, 8, 7	N by E, N by E, N by E.	·006
„ 3	29·637	39·7	35·8	·88	·261	49·3	38·5	10·8	9, 8, 9	NNW, N by E, NE.	·000
„ 4	29·672	37·5	35·8	·94	·242	46·8	35·2	11·6	10, 9, 10	SSE, E by S, NE by E.	·031
„ 5	29·881	42·4	38·6	·88	·287	51·5	34·8	16·7	10, 7, 3	E by S, E by S, E by N.	·067
„ 6	30·014	45·1	40·7	.86	·315	53·2	42·0	11·2	9, 2, 3	E by N, E, NE by E.	·025
„ 7	29·910	40·8	40·7	·99	·271	47·8	40·6	7·2	10, 10, 9	NE, NNE, NE by N.	·008
„ 8	...	...	...	...	...	52·4	41·5	10·9	...	... ...	·010
„ 9	29·903	38·9	39·2	1·00	·254	44·8	42·4	2·4	10, 10, 10	NE by E, NE, N.	·005
„ 10	29·844	43·5	40·4	·90	·298	51·4	42·0	9·4	10, 10, 10	WSW, SW by W, SW.	·191
„ 11	29·528	46·1	44·4	·94	·326	54·8	41·6	13·2	10, 10, 10	ESE, ESE, S by E.	·000
„ 12	29·778	47·5	42·5	·84	·343	58·8	45·3	13·5	7, 9, 10	WSW, SW by S, SW.	·215
„ 13	29·884	48·5	46·7	·94	·354	58·5	49·8	8·7	10, 10, 10	SW, SW, SSW.	·020
„ 14	30·009	46·8	39·5	·78	·334	58·4	40·1	18·3	5, 8, —	WSW, W, W by N.	·021
„ 15	...	...	...	...	...	58·3	39·7	18·6	...	... ...	·178
„ 16	29·924	46·8	45·1	·94	·334	54·9	39·5	15·4	10, 10, 2	SSW, SW, SSW.	·104
„ 17	29·948	50·7	37·6	·64	·382	58·0	45·7	12·3	9, 6, 3	W, WSW, W.	·033
„ 18	29·976	52·2	39·4	·64	·402	61·8	38·1	23·7	0, 4, 3	SW, W by N, WNW.	·000
„ 19	29·808	52·8	44·7	·76	·410	62·5	40·1	22·4	10, 5, 7	S, S by W, SW by W.	·000
„ 20	29·886	47·4	38·9	·74	·341	57·8	43·1	14·7	6, 9, 4	W, W by S, W.	·000
„ 21	30·136	51·1	40·3	·69	·387	60·6	43·9	16·7	6, 6, 4	NW by W, NE, W by S.	·031
„ 22	...	...	...	...	...	55·8	38·2	17·6	...	... ...	·000
„ 23	30·342	44·9	31·5	·62	·313	52·8	39·5	13·3	0, 0, 0	E by N, E, E by N.	·000
„ 24	30·165	48·4	34·2	·61	·353	55·8	38·9	16·9	0, 0, 0	E, E, E.	·000
„ 25	30·068	55·3	35·6	·51	·447	63·4	44·3	19·1	0, 0, 0	E, E, E.	·000
„ 26	29·944	61·4	46·6	·61	·547	71·7	41·7	30·0	0, 5, 4	ENE, SE, SE.	·000
„ 27	29·742	64·4	50·6	·63	·605	74·6	50·4	24·2	0, 6, 10	E, SSW, S.	·000
„ 28	29·469	52·0	51·7	·98	·399	66·8	53·0	13·8	10, 10, 10	SW by W, WNW, NE.	·020
„ 29	...	...	...	...	...	46·5	39·1	7·4	...	... ...	·717
„ 30	29·738	39·1	24·7	·60	·256	46·3	35·3	11·0	7, 9, 6	E by S, E by N, ENE.	·040
Daily Means.	29·866	47·3	40·1	·80	·348	...	...	14·5	...		1·807

* To obtain the Barometric pressure at the sea-level these numbers must be increased by ·037 inch.

HOURLY MOVEMENT OF THE WIND (IN MILES), AS RECORDED BY ROBINSON'S ANEMOMETER.—April, 1866.

Day.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Hourly Means.
Hour.																															
A.M. 12	8	4	8	2	4	10	18	6		6	4	20	15	6	8	18	19	4	5	8	7	1	13	13	10	9	6	3	18	17	9·3
1	6	2	10	2	5	10	19	7	297	4	4	18	15	5	8	19	17	5	2	7	10	1	13	13	10	9	6	1	15	18	9·0
2	3	3	9	1	3	13	20	8		3	4	22	14	6	8	18	18	5	2	6	10	1	13	12	6	6	5	2	14	16	8·6
3	4	5	10	1	7	13	13	11		4	5	19	14	6	8	18	19	5	1	9	10	1	11	14	8	4	5	2	11	19	8·9
4	3	8	8	1	7	16	20	12		4	8	17	16	3	6	19	18	4	1	8	8	2	13	11	9	5	6	3	10	17	9·1
5	3	8	6	2	9	17	18	10		2	7	16	16	2	10	19	19	5	2	8	6	3	13	12	11	5	5	3	12	17	9·2
6	3	7	9	1	11	16	18	8		0	10	12	14	3	11	21	20	6	2	12	7	3	20	15	11	5	5	5	10	16	9·7
7	5	7	12	2	10	17	14	8		1	8	17	16	11	12	21	23	6	2	13	8	8	28	20	12	6	7	5	15	20	11·5
8	4	10	13	4	12	19	17	7		2	11	17	21	15	14	21	24	8	6	16	11	11	32	22	14	9	5	9	16	19	13·4
9	4	11	10	3	14	19	17	8		4	18	20	18	13	14	22	22	7	8	18	10	12	27	27	16	9	8	9	18	22	14·1
10	7	13	13	6	16	25	17	11	22	7	17	17	23	14	17	22	20	8	15	17	12	16	27	27	21	13	7	7	20	23	16·0
11	6	12	9	5	17	28	16	9	20	6	16	17	21	16	18	24	20	9	15	20	8	18	27	31	21	14	10	11	17	22	16·1
P.M. 12	8	15	11	8	17	28	14	10	19	6	20	18	22	15	18	24	21	8	20	16	8	18	34	30	29	11	12	10	19	25	17·1
1	5	15	11	11	19	29	12		16	8	19	21	15	22	20	22	14	9	18	20	7	20	30	30	26	14	12	13	17	25	17·2
2	11	13	10	8	17	28	12		16	9	23	22	17	13	24	19	23	9	17	16	7	18	30	29	23	17	10	13	20	25	17·2
3	10	12	13	10	18	32	7		15	8	21	18	16	13	26	25	21	10	16	11	5	21	29	29	20	14	11	10	18	24	16·7
4	5	11	7	14	20	33	10		14	13	20	14	15	13	23	28	18	10	13	15	8	20	32	27	23	13	11	17	21	25	17·0
5	4	9	6	9	18	20	9		11	9	16	15	13	13	20	27	15	10	13	10	8	17	27	20	22	10	6	16	20	32	14·7
6	1	10	4	9	20	28	10		10	6	16	13	14	12	14	28	12	4	10	10	7	15	26	20	13	12	5	17	19	22	13·3
7	5	10	4	10	16	26	7		10	5	9	12	11	9	16	21	10	5	10	9	1	13	28	15	14	12	4	15	17	20	11·8
8	1	11	4	7	16	22	9		11	7	16	13	10	11	15	22	7	8	11	6	1	13	22	14	15	12	2	13	17	20	11·6
9	1	12	3	8	15	19	5		9	6	22	13	11	9	12	19	8	7	9	5	1	15	17	11	13	11	3	11	17	24	10·9
10	3	14	4	3	12	19	5		8	6	22	12	10	10	15	24	7	5	10	10	2	19	21	10	10	12	4	18	18	25	11·7
11	1	10	4	5	16	16	8		6	4	15	15	8	8	18	18	5	5	10	8	2	14	15	9	7	10	2	17	16	22	10·1
12																															
Total Daily Movement.	111	232	198	132	319	503	315		599	130	331	398	365	248	355	519	400	162	218	278	164	280	548	461	364	242	157	230	395	615	12·9

RESULTS OF METEOROLOGICAL OBSERVATIONS MADE AT THE KEW OBSERVATORY.

LATITUDE 51° 28′ 6″ N., LONGITUDE 0° 18′ 47″ W.

1868.	Reduced to mean of day.					Temperature of Air.			At 9·30 A.M., 2.30 P.M., and 5 P.M., respectively.		Rain—read at 10 A.M.
Day of Month.	Barometer, corrected to Temp. 32°.*	Temperature of Air.	Calculated. Dew Point.	Relative Humidity.	Tension of Vapour.	Maximum, read at 9·30 A.M. on the following day.	Minimum, read at 9·30 A.M.	Daily Range.	Proportion of Sky clouded.	Direction of Wind.	
	inches.	°	°		inch.	°	°	°	0—10		inches.
May 1	29·470	36·0	34·2	·94	·229	41·8	38·8	3·0	10, 10, 10	NE by N, NE, NNE.	0·000
„ 2	29·573	39·9	32·3	·76	·263	48·2	36·5	11·7	10, 3, 1	NW, WSW, WNW.	·140
„ 3	29·614	41·7	37·8	·87	·280	52·8	36·9	15·9	6, 7, 4	—, WSW, WNW.	·136
„ 4	29·843	46·1	29·1	·55	·326	54·8	31·4	23·4	1, 3, 3	NNW, W by N, W by N.	·024
„ 5	30·093	48·0	40·5	·77	·348	57·7	33·6	24·1	7, 9, 7	SW, SW, SW.	·021
„ 6	...	...	...	...	...	58·6	42·5	16·1	...	...	·036
„ 7	30·219	54·9	42·2	·64	·441	62·7	45·7	17·0	2, 3, 6	S, W by S, SW by W.	·000
„ 8	30·005	53·5	40·9	·65	·420	62·6	41·1	21·5	2, 7, 9	SW by W, W, WSW.	·000
„ 9	29·770	52·6	42·7	·71	·408	62·7	47·8	14·9	10, 6, 3	W, WNW, W.	·042
„ 10	29·973	51·0	38·3	·64	·386	58·7	45·2	13·5	8, 8, 8	W, W, W.	·000
„ 11	29·624	50·4	45·3	·84	·378	62·7	49·7	13·0	10, 9, 6	SW, W, W.	·360
„ 12	29·661	46·1	41·8	·86	·326	57·1	42·4	14·7	9, 8, 7	WNW, W by N, WSW.	·025
„ 13	...	...	...	...	...	51·3	39·1	12·2	...	...	·020
„ 14	30·151	45·9	32·1	·62	·324	53·7	38·3	15·4	7, 7, 9	—, E by N, ENE.	·000
„ 15	30·344	44·0	30·8	·63	·303	50·4	35·9	14·5	7, 8, 9	NNW, NE, NE by N.	·000
„ 16	30·363	47·3	35·8	·67	·340	56·2	38·1	18·1	10, 6, 10	ENE, ESE, ESE.	·000
„ 17	30·256	54·5	40·2	·61	·435	62·5	36·1	26·4	4, 6, 2	SW by S, SE by S, —.	·000
„ 18	30·162	56·5	42·5	·62	·465	65·5	34·5	31·0	4, 4, 0	SE by E, E, E by N.	·000
„ 19	30·159	59·4	40·5	·52	·512	67·0	41·0	26·0	1, 2, 0	E by N, E, ESE.	·000
„ 20	...	...	...	...	...	63·2	41·0	22·2	...	...	·000
„ 21	30·358	51·4	39·4	·66	·391	58·8	46·7	12·1	0, 0, 0	E, E, E.	·000
„ 22	30·263	50·3	31·9	·52	·377	57·7	42·2	15·5	0, 0, 0	E by N, E by N, ENE.	·000
„ 23	30·064	55·8	39·7	·57	·454	64·1	41·1	23·0	0, 2, 0	NE by N, NE, NE by N.	·000
„ 24	29·892	45·6	34·1	·67	·321	54·7	42·1	12·6	10, 7, 5	NE by E, E by N, NE by E.	·000
„ 25	29·747	49·0	30·8	·53	·361	56·7	42·3	14·4	4, 3, 2	E, ENE, E by N.	·000
„ 26	29·612	53·5	44·9	·74	·420	64·2	42·7	21·5	7, 9, 9	NE, NE by E, ENE.	·000
„ 27	...	...	...	...	...	63·7	45·3	18·4	...	...	·515
„ 28	29·806	60·0	43·7	·57	·523	68·4	43·7	24·7	0, 4, 4	SE by S, SW by S, SW.	·000
„ 29	29·811	55·0	40·1	·60	·442	64·0	41·7	22·3	0, 6, 8	NE by N, N by W, N.	·000
„ 30	29·882	52·4	38·7	·62	·405	61·7	39·1	22·6	3, 10, 9	E by S, NE, E.	·000
„ 31	29·690	54·7	45·8	·74	·438	63·6	49·4	14·2	10, 10, 10	SE by S, E by S. ESE.	·000
Daily Means.	29·941	50·2	38·4	·67	·382	...	...	17·9	...	...	1·319

* To obtain the Barometric pressure at the sea-level these numbers must be increased by ·037 inch.

HOURLY MOVEMENT OF THE WIND (IN MILES), AS RECORDED BY ROBINSON'S ANEMOMETER.—May, 1866.

Day.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Hourly Means.
Hour.																																
A. M. 12	26	13	3	5	5	7	2	5	11	9	7	17	7	2	3	4	1	2	6	4	13	9	11	6	14	18	6	7	4	7	19	8·2
1	27	12	10	2	5	5	2	5	14	11	9	16	7	2	5	2	2	2	5	2	12	11	11	4	13	17	9	4	1	2	19	8·0
2	25	9	4	2	5	3	2	5	12	10	13	15	4	1	6	1	3	2	4	3	11	10	8	9	12	14	12	1	2	2	19	7·4
3	25	10	4	0	3	3	1	4	13	10	13	14	5	1	6	2	1	1	2	2	9	11	8	14	12	11	5	4	2	2	20	7·0
4	24	10	3	1	2	3	1	3	14	8	19	15	6	3	5	2	3	4	3	5	11	10	7	12	10	13	10	3	2	2	17	7·4
5	19	8	4	1	4	3	1	5	12	10	20	15	7	1	7	2	3	2	5	5	12	9	4	11	15	14	2	3	3	2	15	7·2
6	22	9	6	2	8	3	3	4	12	16	24	15	12	0	9	2	3	2	4	8	16	15	7	15	21	16	2	1	2	1	15	8·9
7	23	11	11	3	14	4	4	5	11	15	22	14	15	1	14	4	6	3	6	12	24	23	8	19	28	15	5	3	2	2	15	11·1
8	25	9	6	4	16	4	1	9	8	18	21	17	15	3	12	9	6	5	7	12	16	27	10	20	28	14	6	3	6	3	13	11·4
9	23	12	7	3	16	4	5	13	9	17	17	17	20	3	12	8	7	4	10	18	28	28	12	16	29	15	4	4	8	3	12	12·4
10	20	11	6	6	18	7	6	15	8	17	17	17	17	5	12	7	6	7	12	20	28	25	12	18	28	18	4	7	8	3	11	12·8
11	20	8	7	7	17	6	7	15	7	16	20	16	14	7	11	5	6	5	10	20	27	27	12	20	28	19	6	8	7	4	12	12·7
12	20	9	11	8	17	6	6	13	13	16	25	14	13	11	10	8	7	6	11	23	35	28	13	23	30	16	5	9	10	6	12	13·0
P. M. 1	20	10	13	10	20	4	6	15	15	14	20	13	15	10	11	8	5	8	14	19	30	32	15	26	26	20	6	10	13	9	16	14·6
2	18	9	13	8	20	4	7	12	15	13	21	13	13	6	10	10	6	6	15	22	30	31	15	25	25	13	6	9	14	8	15	14·0
3	17	8	13	8	13	7	7	14	18	14	25	19	11	11	12	10	5	11	16	24	32	29	15	25	27	15	8	10	15	9	11	14·8
4	17	8	12	10	13	4	7	12	20	10	23	18	13	7	8	10	5	15	15	29	31	31	15	25	27	17	7	11	13	15	10	14·8
5	16	5	9	13	12	3	7	15	19	9	18	12	7	6	12	10	2	17	14	30	27	30	14	25	21	14	5	11	11	16	10	13·5
6	16	4	3	5	11	1	8	15	18	10	21	11	8	12	7	6	7	18	12	22	25	25	13	22	22	13	5	10	11	17	14	12·6
7	16	2	2	6	11	1	8	14	16	13	19	9	4	9	7	10	8	16	11	23	23	23	7	22	20	15	10	6	8	8	8	11·8
8	14	3	2	4	8	0	7	11	10	10	18	7	2	7	8	8	5	11	9	17	18	21	3	17	17	7	9	4	8	17	9	9·4
9	13	3	3	5	6	0	6	11	11	5	16	8	2	7	5	9	4	10	7	15	13	15	3	16	17	5	6	5	8	18	12	8·5
10	14	2	2	5	6	1	6	12	13	9	19	11	2	9	6	10	2	10	6	15	12	15	5	15	13	4	6	3	7	20	11	8·7
11	13	2	4	5	5	2	4	10	8	6	16	7	1	5	4	5	3	6	5	14	16	12	5	15	18	4	15	4	6	15	9	7·9
12																																
Total Daily Movement.	473	187	158	123	255	85	114	242	307	286	443	330	220	129	202	152	106	173	209	364	499	497	233	420	501	327	159	140	171	201	324	10·8

RESULTS OF METEOROLOGICAL OBSERVATIONS MADE AT THE KEW OBSERVATORY.

LATITUDE 51° 28′ 6″ N., LONGITUDE 0° 18′ 47″ W.

1866. Day of Month.	Reduced to mean of day. Barometer, corrected to Temp. 32°.*	Temperature of Air.	Calculated. Dew Point.	Relative Humidity.	Tension of Vapour.	Temperature of Air. Maximum, read at 9·30 A.M. on the following day.	Minimum, read at 9·30 A.M.	Daily Range.	At 9·30 A.M., 2·30 P.M., and 5 P.M. respectively. Proportion of Sky clouded. 0—10	Direction of Wind.	Rain—read at 10 A.M.
	inches.	°	°		inch.	°	°	°			inches.
June 1	29·657	54·8	51·4	·88	·439	66·0	50·6	15·4	6, 10, 8	SE, E by S, ENE.	—
„ 2	29·854	61·7	46·8	·60	·553	71·5	51·4	20·1	3, 5, 1	SSW, E by N, ESE.	0·030
„ 3	...	...	...	...	...	76·4	55·2	21·2	...	... ...	·000
„ 4	29·838	57·8	55·5	·92	·485	68·7	55·4	13·3	6, 10, 10	SW, WSW, SW.	·424
„ 5	29·874	52·2	49·4	·91	·402	62·5	51·7	10·8	10, 9, 9	S by E, S, S.	1·100
„ 6	30·045	53·4	48·6	·85	·419	63·1	51·4	11·7	10, 9, 6	SSW, SW, S by W.	·039
„ 7	30·125	59·1	54·7	·86	·507	71·8	53·2	18·6	10, 8, 8	SSE, SW, SW.	·004
„ 8	30·217	66·2	55·6	·70	·642	75·2	49·9	25·3	5, 7, 3	SW by S, W by N, S by W.	·000
„ 9	30·187	68·8	56·0	·65	·699	80·3	49·4	30·9	4, 4, 9	SSE, SSW, SW by S.	·000
„ 10	...	...	...	...	...	78·6	58·9	19·7	...	... ...	·000
„ 11	30·022	56·5	48·0	·75	·465	66·8	48·3	18·5	7, 8, 9	NW by W, SSW, SSW.	·000
„ 12	29·631	52·2	50·7	·95	·402	62·5	53·6	8·9	10, 10, 10	SW by S, SW, S.	·000
„ 13	29·771	51·3	49·1	·93	·390	60·1	49·8	10·3	10, 10, 10	W by S, WNW, —.	·019
„ 14	29·969	56·7	50·3	·81	·468	65·7	46·7	19·0	10, 9, 7	W, W, W,	·196
„ 15	29·910	56·3	54·0	·92	·462	66·8	47·2	19·6	10, 10, 10	SW, SW, SW by W.	·000
„ 16	29·687	54·0	40·1	·62	·427	64·5	51·3	13·2	7, 7, 3	SW, WNW, W by N.	·000
„ 17	...	...	...	...	...	60·7	41·7	19·0	...	... ...	·101
„ 18	29·547	49·7	50·4	1·00	·369	62·8	45·1	17·7	10, 10, 9	W, S, SW.	·074
„ 19	29·681	55·5	47·4	·76	·450	64·8	51·0	13·8	9, 8, 7	W, SW, W by N.	·038
„ 20	30·038	55·9	52·0	·85	·455	71·3	43·6	27·7	10, 10, 10	S. SSE, S.	·014
„ 21	29·863	66·2	55·8	·71	·642	76·1	54·0	12·1	7, 7, 8	SW, SW by S, S.	·004
„ 22	29·933	61·7	49·1	·66	·553	71·6	56·8	14·8	3, 3, 2	W by N, W, WNW.	·861
„ 23	30·118	64·0	53·8	·71	·597	74·8	49·7	25·1	10, 3, 3	SW, E by N, ENE.	·000
„ 24	...	...	...	...	...	70·3	52·9	17·4	...	... ...	·000
„ 25	30·081	61·9	57·4	·86	·557	72·2	50·5	21·7	10, 9, 5	NE by N, NE, NE by N.	·000
„ 26	30·018	68·4	54·3	·62	·690	76·8	56·6	20·2	0, 1, 0	E by N, E by N, E by N.	·000
„ 27	29·882	65·0	61·0	·88	·617	79·5	58·0	21·5	3, 5, 5	NE by N, W, —.	·000
„ 28	29·948	68·6	56·1	·66	·694	80·8	58·9	22·9	1, 4, 8	—, —, —.	·257
„ 29	29·960	62·8	57·4	·83	·574	74·3	58·8	15·5	10, 7, 7	NNW, NE, N.	·000
„ 30	29·777	64·4	58·2	·81	·605	78·8	56·8	22·0	3, 9, 6	SW by S, N by W, NNW.	·000
Daily Means.	29·909	59·4	52·4	·76	·521	...	...	18·3	...	... ...	3·161

* To obtain the Barometric pressure at the sea-level these numbers must be increased by ·037 inch.

HOURLY MOVEMENT OF THE WIND (IN MILES), AS RECORDED BY ROBINSON'S ANEMOMETER.—JUNE, 1866.

Day.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Hourly Means.
Hour.																															
12	10	6	11	2	15	15	7	2	1	2	14	10	9	2	6	5	13	8		7	3	2	2	10	2	7	13	5	4	4	6·8
A.M. 1	10	6	10	2	10	15	5	1	1	3	10	10	9	4	4	6	10	6		5	3	2	3	7	3	7	11	2	4	4	6·0
2	6	7	10	4	11	16	5	2	2	1	7	3	13	3	5	5	15	6		5	2	3	2	3	5	8	9	2	7	0	5·8
3	6	6	12	4	6	16	7	2	2	1	7	4	14	4	7	3	15	6	187	3	5	2	2	3	5	6	6	3	8	2	5·8
4	5	7	13	4	6	14	6	1	1	1	6	8	13	3	5	2	17	7		4	6	2	3	5	9	6	6	4	9	1	6·0
5	3	7	13	2	7	15	6	4	2	3	3	14	13	3	5	5	15	10		1	6	4	2	7	10	6	6	3	7	2	6·3
6	3	7	11	4	13	16	9	1	1	4	4	15	15	4	13	7	18	12		2	8	9	1	6	9	9	8	4	10	3	7·8
7	9	4	11	6	16	19	11	7	1	7	3	14	17	5	12	7	18	11		6	12	9	4	7	8	9	8	5	10	2	8·6
8	8	4	11	8	14	17	11	8	2	8	4	16	17	5	13	10	23	11		8	14	8	4	11	11	10	4	4	10	5	9·6
9	8	5	11	3	14	16	11	9	5	10	2	17	14	6	15	12	21	18		10	14	4	3	14	11	11	4	2	11	5	10·0
10	7	10	14	4	17	16	13	13	6	17	10	18	11	8	20	17	23	21	21	8	20	11	3	18	11	15	10	6	12	8	12·9
11	5	9	14	6	21	19	13	9	8	15	10	20	9	6	16	20	20	25	23	13	18	10	6	18	9	18	12	6	8	9	13·2
12	9	7	20	10	23	20	15	11	8	13	12	9	10	7	15	19	21	27	25	14	16	9	6	17	12	19	13	7	9	14	13·9
P.M. 1	12	6	19	7	26	18	14	9	6	16	13	16	10	10	15	19	18	25	25	17	17	10	3	18	11	19	9	8	7	6	13·6
2	10	5	17	6	21	15	15	10	8	20	15	17	8	11	15	21	19	24	22	18	17	10	10	19	13	18	4	7	7	8	13·7
3	9	8	14	8	16	18	13	10	7	21	15	16	6	10	15	20	14	22	21	15	15	10	12	18	12	16	4	11	5	5	12·8
4	12	16	14	9	24	16	13	10	9	20	18	17	5	8	11	27	10	23	33	13	12	12	8	17	13	17	2	10	6	12	13·9
5	11	13	12	5	22	14	11	10	6	16	20	15	2	10	14	19	9	21	25	9	8	8	11	12	12	12	4	6	8	11	11·9
6	11	12	9	10	14	12	10	5	4	17	16	16	0	6	15	18	11	24	22	9	6	7	13	11	13	9	6	6	10	13	11·2
7	11	12	7	8	17	7	8	4	5	12	10	17	3	8	12	18	5	22	16	8	3	6	13	4	7	7	3	9	5	8	9·2
8	10	13	5	14	14	6	5	3	5	17	10	13	4	7	10	17	7	20	11	6	6	5	11	4	6	3	3	5	3	10	8·4
9	8	9	5	12	13	4	3	3	5	11	12	13	3	6	11	14	7	17	8	6	6	2	9	4	7	5	2	6	3	8	7·4
10	13	10	2	11	14	7	4	1	1	13	12	14	4	6	9	16	6	16	7	7	7	3	13	4	4	7	4	3	2	8	7·6
11	8	11	3	12	13	5	3	1	2	8	9	11	4	7	8	14	6		4	4	4	4	9	1	7	7	2	3	4	13	6·4
12																															
Total Daily Movement.	204	200	268	161	367	336	218	136	98	256	242	323	213	149	271	321	341	832		198	228	152	153	238	210	251	153	127	169	161	9·4

ARCHÆOLOGIA.

Another example of the primitive canoe has lately been found in Whettall Moss, about three miles from Ellesmere, in Shropshire, in the course of some extensive excavations for agricultural drainage on the estate of Earl Brownlow. As the men were employed in cutting a main drain, they came upon this canoe, at about six feet below the surface. A large birch tree was growing over it. The canoe was found in tolerably perfect condition. It is eleven feet long by two feet five inches wide, and one foot four inches deep. A considerable number of similar canoes, usually about the same dimensions, have now been found in different parts of Britain, but never in such immediate connection with relics of known date as to enable us to fix the period or periods to which they belong. Our own opinion is that, for the most part, they are by no means necessarily of so remote a date as has sometimes been ascribed to them.

A rather interesting sample of a Roman Tesselated Pavement has been found in the churchyard of Caerleon, the site of the *Isca Silurum* of the Romans. It was carefully taken up, and removed into the museum of the Caerleon Antiquarian Society, where it will be preserved. It offers a good specimen of the labyrinthine, or maze, pattern, of which other examples might be pointed out. This is not the only instance in Britain of a fine tesselated pavement being found under a churchyard, a position no doubt arising from the circumstance that at the time the church was first built, the builders selected a spot which had been occupied by a previous building of some extent, such as a Roman villa, the ruins of which furnished them with plenty of building materials ready at hand; and the ground covering the pavements of some of the larger rooms offered a clear space which would serve conveniently for the churchyard. This was the case with the principal apartment of the extensive villa at Woodchester, in Gloucestershire, the pavement of which lies under the modern church and churchyard, in consequence of which the mosaic work has been cut through and broken up in all parts by the sinking of graves.

Some Anglo-Saxon Antiquities, found in excavations in Leicester and the neighbourhood, have recently been laid before the Leicestershire Architectural and Archæological Society. The more remarkable of these relics were discovered in the parish of Glen Parva, some four miles from Leicester, in a grave containing a skeleton which is assumed, from the objects found with it, to be that of a Saxon lady. There were two bronze pendants, perhaps part of a sort of chatelaine which is often found in such graves, and appears to have been suspended to the lady's waist; three bronze fibulæ; part of an article made of bone, supposed to be an amulet; two flat pieces of bone, with corresponding rivet-holes, and one bone rivet remaining, apparently belonging to the handle of a knife; a drinking vessel of thin glass, which was broken to pieces in taking it out of the earth; two large finger rings; several beads, of glass and

other material; and a crystal ornament, cut in facets like a diamond, and drilled through, which measures in its horizontal diameter nearly two inches, and in its transverse diameter not quite an inch and a half. There was also found in this grave the claw of an animal, pierced through, evidently for suspension on the person.

T. W.

The Rev. W. Kilbride, vicar of Aran, and G. H. Kinahan, F.R.G.S.I., of the Geological Survey of Ireland, have recently discovered the sites of two ancient settlements on the Islands of Aran, County Galway. The settlement on Inish More, the largest of the islands, consists of eight Cloghauns, or dry stone cells with "beehive roofs;" fifteen Cnocāns, or dry stone beehive cells covered with clay; four Fosleac, or cells built of and roofed with flags; four Ointigh, or dry stone cells that had not beehive roofs; two Doons, and one Cashel. The settlement on Inish-Maan, the centre island, consists of thirteen Cnocāns and Cloghauns and one small Doon.

PROGRESS OF INVENTION.

NEW REGULATOR OF VELOCITY.—Motion is rarely obtained continuously from any source in such a state of uniformity, as the purpose for which it is destined requires. Hence ingenuity has devised a number of contrivances which, if they, in no case render the motion perfectly uniform, in most they regulate it with sufficient precision for the attainment of the intended object. The regulators used with chronometrical instruments give riseto periodica l alternations of rest and motion; which though objectionable from the necessity of alternately destroying motion and overcoming inertia, is found to comply sufficiently with the conditions which are to be fulfilled. Such regulators, it is obvious, would be inapplicable where interruption of motion is inadmissible; and hence regulators, founded on different principles, are then indispensable. It might be supposed that friction would answer the purpose of absorbing the excess of motion which would produce augmented velocity; but such is not the case, as the circumstances which give rise to friction are so various, and so little under control; and hence it is never used as a means of regulation, when great exactness is required. The resistance of the air affords a more suitable mode of regulation. As the resistance offered by the air to any surface moving in it, is proportionable to the square of the velocity, it is clear that the resistance increases much more rapidly than the velocity; and that the velocity of any body having a large surface will be but little affected by slight variations in the power. It will, however, be affected; and hence absolutely uniform motion is unattainable when the regulator consists of revolving vanes. The happy idea occurred to M. Leon Foucault, of combining with the principle of revolving vanes that of the centrifugal governor used with the steam engine, etc.: and the result is a regulator of great simplicity, which affords a motion

that may be considered absolutely uniform. In this apparatus, the rods and balls of the centrifugal governor are replaced by oblong triangular thin plates of metal, constituting vanes, which are hinged by their vertices to the revolving upright spindle, and move in the same vertical plane. They are prevented from flying out to their full extent by slight increments in the velocity of rotation, by spiral springs which, being fixed to their centres of gravity, are the causes of no disturbing influence. When the velocity is that which is required, the resistance offered by these vanes, as they hang down along the revolving spindle suffices to absorb the excess of motion, so as to prevent the velocity from becoming accelerated; but the slightest increase of velocity causes them to fly asunder by means of centrifugal force, and to an extent which depends on the increase of velocity. As the distance of the vanes, and especially of their broader portions, from the axis of motion is increased, the resistance they experience from air, which has also been augmented by the increased velocity, is increased; and hence equilibrium is soon established between the disturbing and controlling agents. The velocity which this apparatus will permit is entirely under control; since it depends on the size of the vanes, the quantity of matter they contain, and the relative power of the springs. When one velocity is to be changed into a very different one from that previously required, it is necessary to change the springs; but when the desired alteration is inconsiderable, movable metallic masses, are merely slipped up and down along the vanes by means of screws, so as to alter their distance from the axis of motion, when the vanes fly apart. This affords an easy mode of regulation to any velocity desired. So accurate is the adjustment of velocity obtained by this contrivance that power may be taken for any required purpose from a clock regulated by it, without disturbing the accuracy of the rate of going.

A New and extremely Powerful Electrical Apparatus.—The production of electrical currents by means of magnetism, or electro-magnetism, is used by Mr. Wild of Manchester for the obtaining of enormous quantities of electricity, by means of a contrivance which, considering its vast power, is neither complicated nor expensive. He was led to the invention of this apparatus, by discovering a mode of utilizing the important fact ascertained a considerable time since by M. Seguin, that a very large quantity of electricity may be developed in an electro-magnet by a permanent magnet of very small power. As an electro-magnet possesses all the properties of a permanent magnet, the effect thus obtained can, of course, be multiplied to any extent, by successive elements added to the apparatus; but it was found that the principle repeated three times, that is by the use of three elements; afforded quantities of electricity quite as large as could be desired. Each element of this apparatus consists of one or more, either permanent or electro-horse-shoe magnets, and a kind of cylinder within which revolves an armature. The cylinder, or rather the cylindroid, which has four flattened sides, constituting a kind of quadrangular prism, having rounded corners parallel to its length,

consists of two plates of cast iron, placed opposite to each other, and united by two plates of brass. In the ends, which are of some non-magnetic substance, are small circular apertures, that allow an armature to revolve in the axis of the cylindroid. This armature is a cylinder of iron, down the two sides and across the ends of which are deep grooves, within which is wound a helix, formed of copper wire 0.03 of an inch in diameter, and about 160 feet in length. When the cylindroid is placed between the poles of a magnet, so that the latter are in good contact with the cast-iron plates, and the armature is made to revolve, it is evident that two opposite electric currents are formed in its helix during each revolution of the armature. All the currents may, by means of a commutator, be made to pass in one direction, and when the rotation is very rapid, the amount of electricity produced by even a single, permanent magnet, is very great; but every additional magnet placed on the cylindroid causes the addition of an equal effect. If the electric current thus obtained is made to excite one or more electro-magnets, the poles of which are in contact with a cylindroid similar to the first, and the two armatures are made to revolve rapidly, the effect becomes very considerable. And if the second current is transmitted through the helices of other electro-magnets, the poles of which are in contact with a third cylindroid, the third secondary current thus obtained is of great power. With four permanent magnets, each only one pound in weight on the first cylindroid, the armatures in the first two cylindroids being two inches and half in diameter, and that in the third cylindroid ten inches, a current was obtained which, with carbon electrodes, and a parabolic reflector, produced so intense a light on the top of a lofty building at night, that shadows were projected by the flames of street-lamps a quarter of a mile distant. The calorific power of the apparatus sufficed to melt an iron rod a quarter of an inch in diameter, and copper wire 0.125 of an inch in diameter; and to keep twenty-one feet of iron wire 0.065 of an inch in diameter at a red heat. This instrument seems applicable to lighthouses and numerous other practical purposes; since it is neither very large nor very costly, and the only expense its working entails is the rotation of the armatures, which should each make about 3000 revolutions per minute. Its effects at first sight would appear at variance with the ordinary laws of the conservation of force; but all difficulty will vanish if we remember that the machine is merely an apparatus for changing rotary motions into electricity. In many cases, the motion required may conveniently be obtained from a steam engine.

Peroxide of Hydrogen.—This curious compound, which is every day being applied to new uses, and is likely to become a very valuable agent in the hands both of the philosopher and the manufacturer, may, as Schönbein has discovered, be prepared with great facility, by agitating in a large receiver, into which the air has free access, amalgamated zinc in powder and distilled water. The oxygen of the air combines both with the zinc and water, oxide of zinc and peroxide of hydrogen being formed. The peroxide of

hydrogen does not contain a trace of either zinc or mercury; and being quite free from acid, it remains for a long time without decomposing.

Improved Electrotype Process.—Christofle and Bouillet, of Paris, have introduced three great improvements into the electrotype process. They add to the silver bath sulphuret of carbon, or an alkaline sulphuret, which produces a small quantity of sulphuret of silver; and this, for some reason not yet explained, causes the silver deposit to be, not dim and lustreless, but as brilliant as if it had been carefully burnished. They add to the sulphate of copper bath a moderate quantity of gelatine, which, for some reason, also as yet unexplained, causes the copper deposit to be as compact and dense as the very best rolled sheet copper. And lastly, they secure very great economy, by attaching plates of lead to the platinum wire, which forms the interior skeleton of the mould used for the production of articles in relief. The results produced by this modification of M. Lenoir's process affords products yet more perfect than those obtained by casting and chasing.

Reproduction of Designs on Glass.—The decoration of porcelain with designs embracing every grade of excellence, and at a very trifling cost, compared with the beauty of the products, has long been practised in this and other countries. But, hitherto, glass appeared to be incapable of receiving any kind of ornamentation except by methods tedious, difficult, and expensive. It is likely, however, that such is now no longer the case, as a process has been invented in France, by means of which engravings are transferred to glass with nearly the same facility as they have hitherto been transferred to ceramic products. In the case of porcelain, fine lined copper plate engravings on tissue paper are applied to the surface of the article, the engraved side inwards; and the paper having been washed away, the lines of the engraving which still adhere to the porcelain are permanently attached by firing and glazing. In the case of glass, this process requires to be modified; a fine lined engraving would not answer, and hence, one having lines of sufficient depth is used. Also, stearates and oleates are added to the silicates and borosilicates, which are intended to support, or to fuse the coloured or colouring oxides, for the purpose of giving to the enamels the thickness which glass requires them to have; and a solution of resin in ether or benzine is added. The engravings on paper are produced by means of engraved rollers; and, after having been treated very much in the same way as with porcelain, the glass is placed in the furnace, and thus the most beautiful results are obtained with certainty, ease, and economy.

Oxygen in a Different State in Different Peroxides.—Our knowledge regarding the different conditions in which oxygen may exist is receiving constantly new accessions. Not the least important of these is the fact recently discovered, that the oxygen in the peroxide of manganese is in a very different state from that in the peroxide of barium: a circumstance which is strongly confirmative of the theory of Schönbein, that oxygen may exist in two opposite states, which he has termed *ozone* and *antozone*, oxygen in its ordi-

nary state being a combination of both. It has been proved by recent researches that the oxygen in peroxide of barium is in the form of ozone, and that in the peroxide of manganese in the form of antozone. The consequences which follow from these discoveries are of a most interesting description: since if the two kinds of oxygen enter into combination, it is probable that the elements with which they combine exist in two allotropic states; and the inference may indeed be extended indefinitely, so as to lead to a belief that also all the elements, and perhaps all their compounds, are capable of existing in two opposite allotropic states. The facts which demonstrate that the oxygen elements in the peroxides of barium and manganese are in very different states, are very remarkable, and are such as admit of no doubt. Thus the oxygen in the peroxide of barium has a less affinity for hydrogen than chlorine, since, when it is acted on by the latter, hydrochloric acid will be formed, oxygen being given off; while on the contrary, hydrochloric acid is decomposed by peroxide of manganese, chlorine being evolved. It is worthy of remark that the oxygen given off by the peroxide of barium is in the form of ozone. Again, if peroxide of barium is treated with hydrochloric acid, peroxide of hydrogen will be formed; but if peroxide of manganese is treated with the same acid, ordinarily, water will be formed, and chlorine evolved. Sulphovinic acid, if heated in presence of peroxide of barium, affords ether, bicarburet of hydrogen, and sulphurous acid; but if in presence of peroxide of manganese, aldehyde. Peroxide of hydrogen may be formed by means of either peroxide of barium or peroxide of manganese; but the two peroxides of hydrogen thus obtained are very different, since each will be decomposed by the peroxide employed in forming the other; and, what is still more remarkable, they will decompose each other.

MISCELLANEOUS.—*Damping Apparatus for Copying.*—In copying letters, the most troublesome portion of the process consists in damping the paper: this is greatly facilitated by means of a simple apparatus recently invented in Germany. It consists of a hollow perforated roller covered with linen, and rotating on a tube connected with the handle, which serves as a reservoir for water. When the roller is in use, the water flows from the handle into the tube, thence into the perforated roller, and thus the linen is kept wet while being rolled over the paper. When the instrument is not required, it is left in such a position as causes the water to flow back into the handle.——*Purification of Water.*—There is good reason to believe, from certain experiments recently made, that any kind of water may be freed, not only from the impurities it contains in suspension, but also those it holds in solution, and may thus be made fit for drinking, by adding to it a very small amount of a solution of permanganate of potash, and then filtering it through a layer of magnetic oxide of iron and carbon, a few inches thick. The required mixture may be obtained by heating in a close vessel red oligist ore and a small quantity of sawdust.——*Petroleum as Fuel.*—In the ordinary modes of using petroleum as fuel, there is very frequently produced a very large quantity of black smoke,

which not only is very offensive, but a source of great waste. This is entirely prevented by mixing superheated steam with the petroleum vapour, as has been done for some time past in America, and more lately at Woolwich Dockyard; which causes the smoke instantly to disappear, and the whole fire-place and tubes to be filled with a bright white flame. We need not remark that the decomposed water causes no addition to the total amount of heat, since water absorbs the same quantity of heat during decomposition as its elements afterwards give out during combination. The economy arises from the waste of a large part of the fuel, as smoke, being prevented.——*New mode of fixing Photographic Prints.*—Chloride of sodium (common salt) was one of the very first fixing agents employed; it was used by Daguerreotypists before Sir John Herschel's discovery that hyposulphite of soda is better suited for the purpose was generally known. A slight modification in the use of it renders it, however, all that can be desired as a fixing agent. The prints, when taken out of the frame, are to be placed for some time in a solution containing five per cent. chloride of it, and the solution is then to be raised to the boiling point, and left at it for about ten minutes. The prints may then be removed and washed, and the pictures will be found completely fixed.——*New Mode of Utilizing Combustible Fluids as Fuel.*—For this purpose a lamp is used in which the turpentine, or other combustible fluid, is reduced to a fine dust by an apparatus, which the inventer, a Russian professor, terms a "pulveriser." The flame produced by means of this is of great size and power, and of a whitish-yellow colour. The heat it emits is so intense as to melt steel. The contrivance is certainly not so economical as the ordinary furnace; but it is expected that, for many purposes, this will be far more than counterbalanced by its convenience and power.

NOTES AND MEMORANDA.

The Dhurmsalla Meteoric Stone.—A paper in *Proceedings of Royal Society*, by Professor Haughton, states that on the 14th July, 1860, at 2.15 P.M., a remarkable meteoric stone fell at Dhurmsalla, and that the cold of the fragments that fell was so intense as to benumb the hands of the coolies who picked them up. A fragment they sent to the museum of Trinity College, Dublin, was analyzed by Professor Haughton, who found 100 parts to contain nickel iron 8·42, protosulphuret of iron 5·61, chrome iron 4·16, chrysolith (peridot or olivine) 47·67, and minerals insoluble in muriatic acid 34·14. The proportion of chrome is unusually large.

New Marine Worm (*Phenacia pulchella*).—Mr. Edward Parfitt describes, in *Annals of Natural History*, No. 103, a new species of marine worm thrown up by the sea at Exmouth on 6th January during a heavy gale. It inhabits a thin, flexuous, horny tube, three inches long. The worm itself is two inches long, the body composed of forty annulations, the anterior of which were armed with two fascicles of yellow bristles of about three or four each, placed opposite to each other. The rest of the rings have about two each, but the numbers vary. Colour pale orange, red mouth with a purple cast. Buccal cirri twenty, white, beautifully

maculated with oblong spots of orange, red down the centre. Dorsal cirri reflexed purple, with faint reddish tinge.

Iodine Dissolves Gold.—M. Nickles states, in *Comptes Rendus*, that if iodine, water, and gold leaf, are heated in a tube to 50° C. (122° F.) the gold is dissolved. Ether may be substituted for water, and the action will take place on exposure to strong sunshine. The filtered solution deposits a film of gold on evaporation, if the heat at the end of the operation is sufficient to decompose the iodide of gold which is deposited. Sesqui-iodides and bromides of iron likewise dissolve gold.

Size and Life of a Mammoth Tree (*Sequoia gigantia*).—M. A. De Candolle, giving an account to the French Academy of the recent Botanical Congress in London, stated that an exact measurement of one of the mammoth trees of California, the "old maid," which was blown down in a storm a few years since, had been made by Mr. Edmond De la Rue. It was found to be twenty-six feet five inches and nine lines, six feet above the ground. Mr. De la Rue traced the annual layers on a sheet of paper which M. de Candolle exhibited, and it was found that the layers amounted to 1234.

Volcanic Emanations and Disease.—M. de Corogna states to the French Academy that in districts towards which the winds blow the gaseous matter given off by the eruption at Santorin, inflammations of the eye, bronchitis, and digestive derangements have been frequent, while other districts have not suffered in the same way. Asphodels, and generally, plants of the lily tribe have been injured. He ascribes the human maladies of indigestion, etc., chiefly to sulphuretted hydrogen, and the vegetable disorders to hydrochloric acid vapours. The ophthalmia is traceable to volcanic dust.

The Zodiacal Light.—M. Liandier has a note in *Comptes Rendus* stating that for several years he has watched the zodiacal light during the evenings of February and March. This year, for the first time, he saw it on the 19th of January, and watched it till the 5th of May. He considers it to have the shape of a perfect cone, varying in luminosity and colour from dull grey to silvery white, the changing aspect probably being occasioned by the condition of our atmosphere. In February the summit of the cone reached the Pleiades, and the Twins in May. Between January and May he found it to follow the zodiacal movements of the sun. He believes the luminous cone to be a fragment of an immense atmosphere enveloping the sun on all sides. If so, he says it may be expected to exercise an enormous pressure on the sun, with great development of heat; and if local variations occur, he thinks they may explain the occurrence of spots through the reduction of temperature that would follow diminished pressure.

Effects of Increase of Sun's Mass.—On the 1st September, 1859, Mr. Carrington and Mr. Hodgson witnesssed a sudden blazing up in the sun, which is supposed to have indicated the fall of an extraneous body into our luminary, and a consequent accession to his mass. In *Monthly Notices*, vol. xxvi., No. 8, recently issued, will be found a mathematical paper computing the effects of the fall into the sun of such a body as our earth, which some persons suppose would produce such a blaze as to scorch up all the planets. Mr. Waterston finds that if the blaze so occasioned were persistent, the general rise of temperature would not exceed 10° or 15°, but he observes that as soon as the falling body had plunged below the atmosphere into the fluid incandescent body of the sun, the blaze would terminate, though the temperature of that part of the sun would be sensibly increased. If the whole potential radiating power of the sun were increased 1000°, he says, "even this is only one twelve-thousandth part of the potential temperature that sends heat to us sufficient to maintain a general average temperature over the surface of the earth of about 500° above the absolute zero of space. Now this proportion of 500° is only one twenty-fourth of a degree, and this is the extreme maximum effect that can be reasonably expected from such a planet fall." But increase of the sun's mass would shorten the year, and the addition of matter equal to our globe would effect this to the extent of 130", causing a difference in the longitude of the sun at the end of the first year equal to 5"·3.

PRISMS AND SILVERED FLATS FOR TELESCOPES.—A paper by Mr. Browning will be found in *Monthly Notices*, comparing the action of a prism and a silvered flat when used with the glass reflecting telescopes. The prism he finds to reflect more light, as might have been expected, and he found that when a prism and a flat, placed side by side, threw down two pencils of the light from a paraffin lamp, that the circle of light from the prism looked *white*, while the other was strongly tinctured with a reddish chocolate colour. We have made experiments with prisms and flats fully according with Mr. Browning's results. The prisms, if accurate in form, are far superior to the silvered flats in light and colour, and quite equal to them in point of definition. Mr. Browning exhibited to the Astronomical Society a fine prism made for Mr. De la Rue.

FUNGUS IN A TREE.—The *Archives des Sciences* has an account of a paper by Signor Gasparini, in which he states that a fine *Acacia dealbata* from New Holland, when in full flower in a garden at Naples, was broken through its stem by a slight blast of wind. It was found that the heart wood was black and rotten, and microscopic examination revealed the mycelium threads of a fungus. The medullary rays, pith, and spiral vessels were not attacked, but the dotted vessels (*vaisseaux ponctués*) were so. Signor Gasparini considered that the spores of the fungus had introduced themselves through the rootlets. He states that when the spangioles have been broken in plants of the lily tribe, spores have found entrance, and occasioned damage.

STRANGE EFFECT OF LIGHTNING.—*Cosmos* states, on the authority of M. Saillant, that on May 15 an oak was struck by lightning in the forest of Vibraye (Sarthe) at about two-thirds of its height, at the origin of the large branches. The upper third, comprehending the crown and its branches, was not touched, but the remainder of the tree was split to shivers, and dispersed in all directions. No vestige was found of the bark, the root was partly torn up, and a heavy fragment hurled more than fifty paces. "The most curious thing is that the top of the tree was stuck in the ground, just where the original trunk was, so that the trunk and roots must have been swept away the time the tree-top took in falling."

ACHROMATIC EYE-PIECES FOR TELESCOPES.—For ordinary use the Huyghenian eyepiece will probably remain the favourite for achromatic telescopes, though for extent of field Horne and Thornthwaite's aplanatics are preferable. For reflecting telescopes, now coming into more general use since the success attained by Mr. With and Mr. Browning in making and mounting the silvered glass mirrors, the Huyghenian eye-piece scarcely works as well as it does with the achromatic. In the latter case the Huyghenian eye-piece corrects errors which do not exist in reflectors. Mr. Browning has constructed a series of achromatic eye-pieces to work with the silvered glass reflectors, and, after giving them many trials, they appear to us decidedly advantageous where smallness of field is not objectionable. If a good Huyghenian eye-piece is employed on Saturn or Jupiter, and then an achromatic of the same power, a noticeable improvement in definition is obtained. Thus the divisions in Saturn's ring can be seen with the achromatic eye-piece when the Huyghenian will scarcely indicate them. We recommend those who possess reflectors to try Mr. Browning's achromatic eye-pieces.